Terrazzo & mosaic

The National Terrazzo & Mosaic Association, Inc. Catalogue

This book is number
of a limited edition

5129

A. I. A. FILE No. 23 E

The Purposes and Aims of the National Terrazzo & Mosaic Association are:

1. To increase the use of terrazzo and mosaic by architects, owners, general contractors, and the building industry in general through educational and promotional methods.

2. To obtain, disseminate, and exchange among the members accurate information regarding all matters conducive to the improvement of conditions within the industry; to promote harmony in the relations between employer and employee in the industry; to promote friendly relations among those engaged in the industry; and in general to do all things necessary and proper to carry out the foregoing statements.

3. To see that all persons using terrazzo and mosaic shall receive the best workmanship and materials on their projects so as to insure the best service, beauty, and wear that our product can give, and to serve as a court of last appeal on any questions arising between owner, architect, or builder and the terrazzo contractor concerning terrazzo and mosaic work.

By these purposes the National Terrazzo and Mosaic Association hopes to carry out its slogan of "To Serve the Users and Producers of Terrazzo." In our opinion architects, general contractors, and owners may be assured of better terrazzo and mosaic work when such work is executed by contractors who are members of this association and who have the authority to use the Association label: "The Symbol of Quality."

terrazzo mosaic

marble mosaic

dividing strip patterns

glass mosaic

pre-cast terrazzo

Catalogue and design book

third edition

This Book contains a complete set of Plates, reproducing samples of Terrazzo, covering a wide range of Marble Mosaic and Glass Mosaic Patterns and Designs.
Divider Strip patterns, Names and Designs.
Application of Terrazzo to Stairways, Wall base, Partitions, Wainscot, Shower Basins, Conductive Operating Room Floors.
Construction Details, and General informative matter.
Colored Plates of Photographic reproductions of various prominent Terrazzo Installations.

Published jointly by

The National Terrazzo & Mosaic Association, Inc.

and **The Manufacturers Division, Inc. of the N. T. & M. Association**

Washington, D.C.

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* Revised March 1954

Acknowledgment

We acknowledge with many thanks the great assistance rendered to our membership by the individuals and firms named on the previous page, in contributing to the cost of this booklet and to the cooperation of many members of these firms in furnishing photographs, color plates, informative matter and various data that has gone into the contents of this book, to make it a most complete reservoir of information, on the subject of Terrazzo and Mosaics.

Introduction

We present this new version of our previous catalogues to the building industry to bring our improved methods and skills up to date. Since publication of our first catalogue and design book in 1926 and our book of sample plates in 1932, great strides have been made in improved methods, in the laying of Terrazzo floors and in the application of divider strips to these floors. Better coloring matter is now available and marble aggregates are being crushed to a uniform standard size.

Details, photographic reproductions, informative matter on various types of mosaic work, specifications, care and maintenance of Terrazzo work, as well as many diversified matters relating to this industry is included in this book.

The color plates represent exact reproductions of samples made from specific formulae. These formulae are exclusive property of members of the National Terrazzo & Mosaic Association.

The color plates are arranged in two groups. One set of samples are made with Grey Portland Cement, the other with White Portland Cement. A permanent tone Terrazzo is made only with Portland Cement and can be guaranteed for life of the building in which this work is a part. Terrazzo mosaic work made with Portland Cement improves with age and becomes continuously harder as it ages. Its density permits the development of a natural gloss giving it the bright and cheerful appearance which has given Terrazzo an envious reputation. In maintenance it has no peer. It is the most economical material to clean, needs no repairs or up-keep, demands little attention, and holds all maintenance costs to a minimum.

In this book, our Third publication, we are presenting to the building industry, a collection of photographic plates of Terrazzo samples, chosen for the general appeal they have made to those who have used modern Terrazzo & Mosaics, in its various forms in many different types of buildings and structures. Since this book is a loose leaf collection of samples, data and other informative matter, each page can be handled singly. This makes for convenience in showing several samples collectively, as well as individually.

Patterns and designs are shown further along in this book, offering suggestions in the use of the divider strip for planning simple, geometric patterns, as well as the fundamentals, from which the more elaborate and decorative patterns can be developed.

Another section of this book illustrates the use of marble mosaic and glass mosaic (smalti-) in simple and decorative art.

Precast Terrazzo (Art Marble) is described and illustrated.

Nonslip Terrazzo Floors, Nonslip Treads, Nonslip Aggregates and Inserts are also described and illustrated.

Details of construction and application of Terrazzo to various types of supporting floors are clearly illustrated, as well as the various methods of applying Terrazzo to walls, stairs, etc.

Included in this book you will find informative matter and illustrations of conductive Terrazzo for safety in anesthetizing locations. The use and application of metal beads to wall base. Illustrations and descriptive matter on outdoor Terrazzo installations. Illustrations and descriptive matter on Radiant heat installed under Terrazzo floors. Specifications and construction data on Terrazzo floors laid in skating rinks. Terrazzo maintenance, instructions on how to clean Terrazzo work and kinds of cleansers, etc.

The National Terrazzo & Mosaic Association's Standard specifications are also a part of this catalogue.

You will be assured of obtaining best results by patronizing the members of the National Terrazzo & Mosaic Association, through whose efforts this catalogue was made possible.

grey portland cement

terrazzo plates

Portland Cement is the binding or bonding agency used in the making of Terrazzo Mosaic. Generally speaking, two parts of Marble (or other granules) aggregate is mixed with one part of Portland Cement to make the Terrazzo matrix. Portland Cement is also the binding element of the Terrazzo concrete sub-bed and to be doubly sure that the concrete bed and the Terrazzo finish become homogeneous, Portland Cement as a grout is brushed over the concrete sub-bed before the plastic Terrazzo topping is laid on it.

Early in the nineteenth century Joseph Aspin, a bricklayer of Leeds, England first made Portland Cement by burning powdered Limestone and Clay in his kitchen stove. He patented Portland Cement in 1824, the name of Portland was given to this new material, because it resembled in color, a natural stone quarried on the Isle of Portland in the English Channel.

Portland Cement is a chemical combination of Lime Silica, alumina, iron oxide and other ingredients in small quantities. It is made from crushed rock (limestone) shells and chalk or marl, combined with shale, clay, slate or blast furnace slag. These raw materials are crushed, mixed in proper proportions and fed into a Kiln. These huge rotary Kilns, where the temperature is raised to 2,700 degrees Fahrenheit change this mixture into a "clinker," forming pieces about the size of a marble. When the "clinker" has cooled it is put through a grinding machine, where gypsum is added to regulate the setting time of the ultimate product.

The grinding process reduces the "clinker" to a very fine powder passing through a screen containing 40,000 openings to the square inch. The finished product is automatically bagged, each bag containing one cubic foot of cement and weighing 94 pounds, and four bags weighing 376 pounds is known as a barrel, a unit of measure as used by the U. S. Bureau of Mines.

The first Portland Cement made in the U. S. A. was produced by a mill in Pennsylvania in 1872. Today the combined mills of this country produce in the neighborhood of 240,000,000 barrels annually.

A geometrical pattern, made with various shades of grey cement.

grey cement

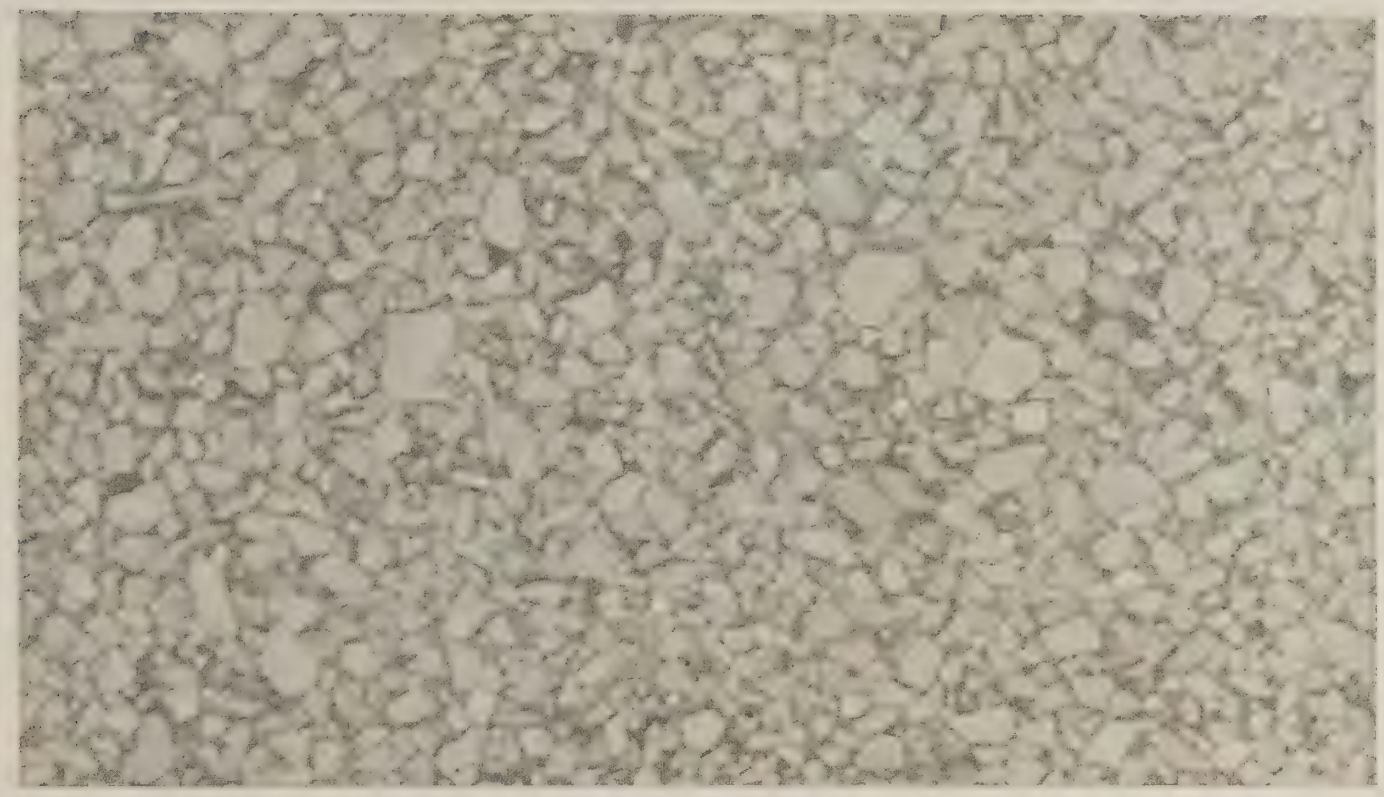

Plate 101

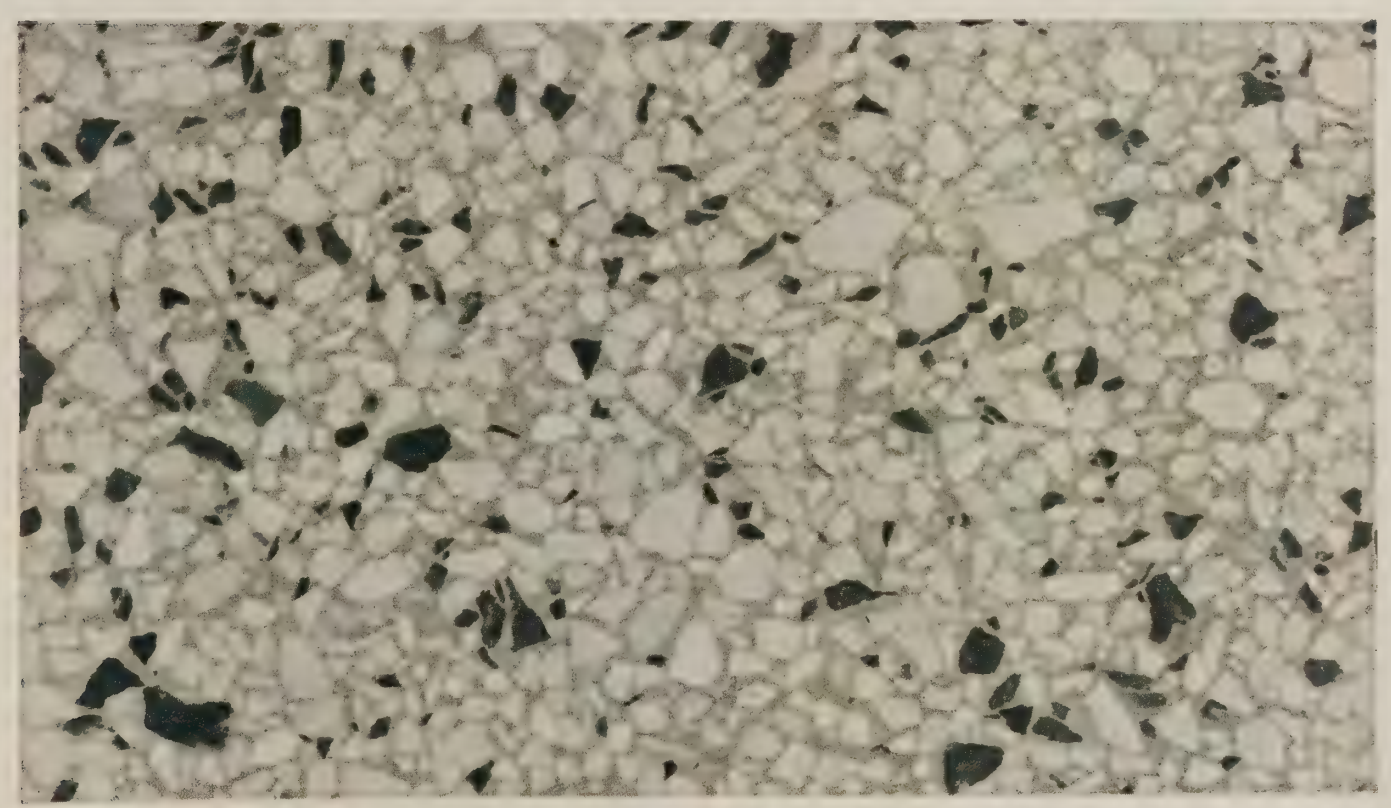

Plate 102

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grey cement

Five reasons

why you will want terrazzo

1. **Economy**—For Terrazzo, initial cost ***without*** replacements ***plus*** minimum upkeep costs over a period of years, usually is less than initial cost ***plus*** replacements and higher upkeep costs for other types of floors.

2. **Comfort**—Finished Terrazzo is ***easy to walk on.*** It is inherently non-slip in nature and provides a safe walkway surface.

3. **Cleanliness**—Terrazzo has a smooth, jointless surface which ***cleans easily,*** and thus is sanitary and aseptic. It can be sealed so as to be practically non-absorbent.

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grey cement

Plate 103

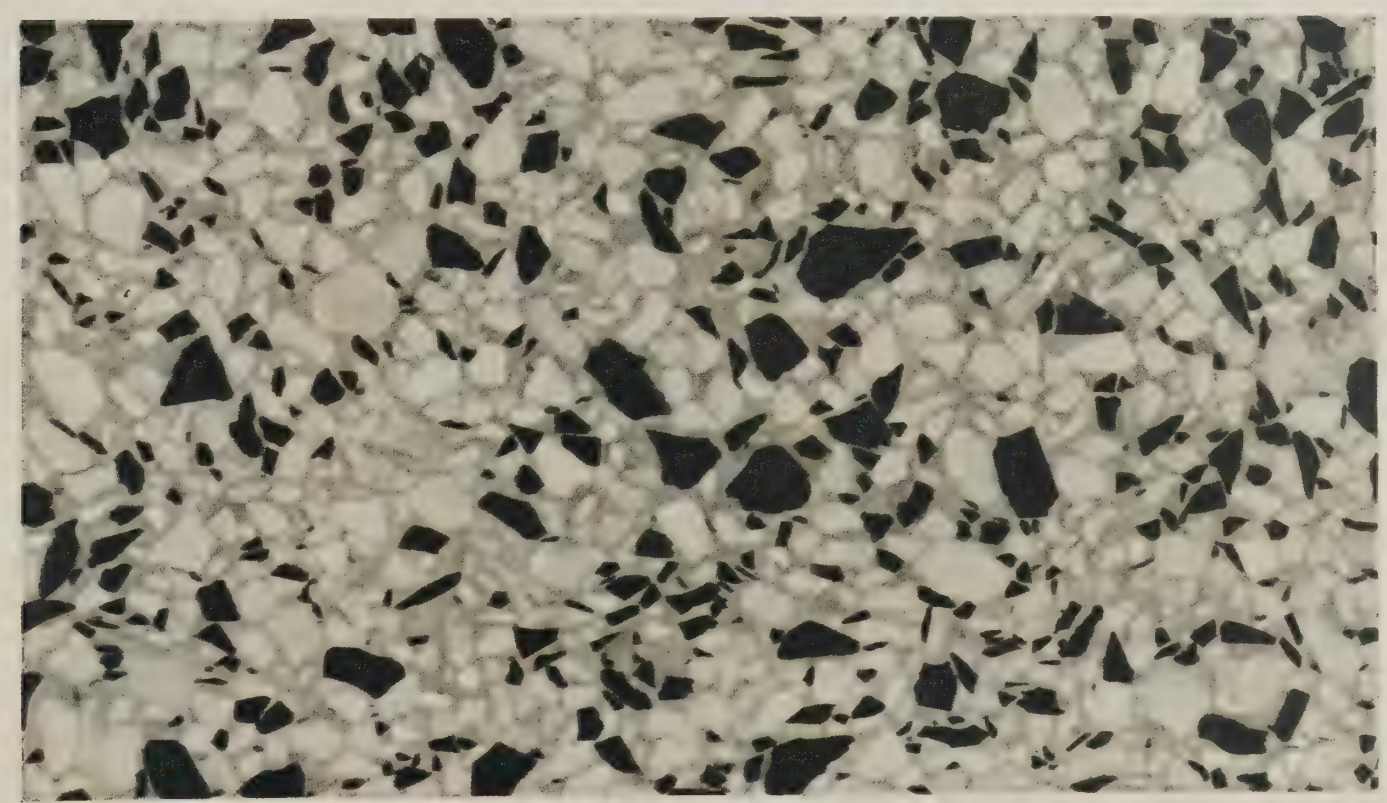

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Plate 105

Plate 106

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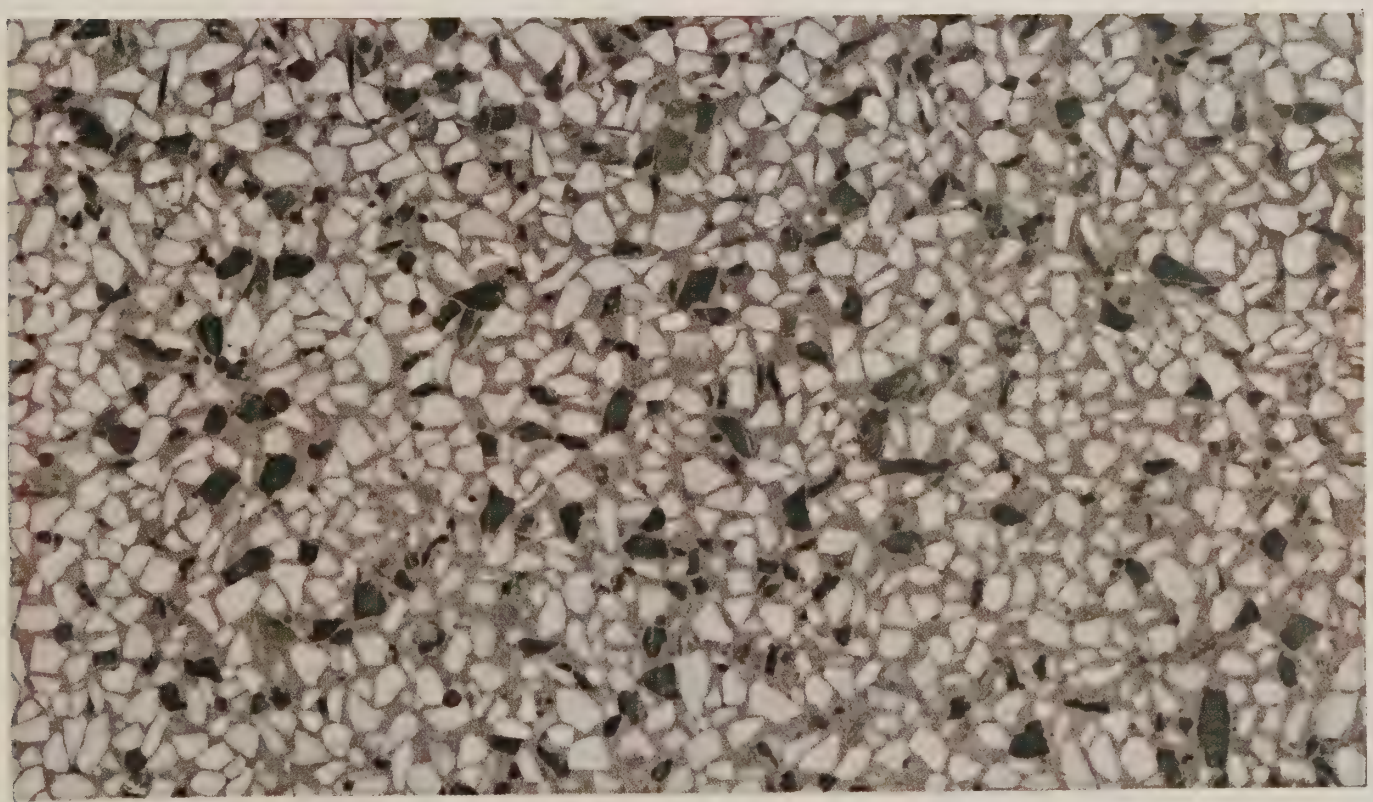

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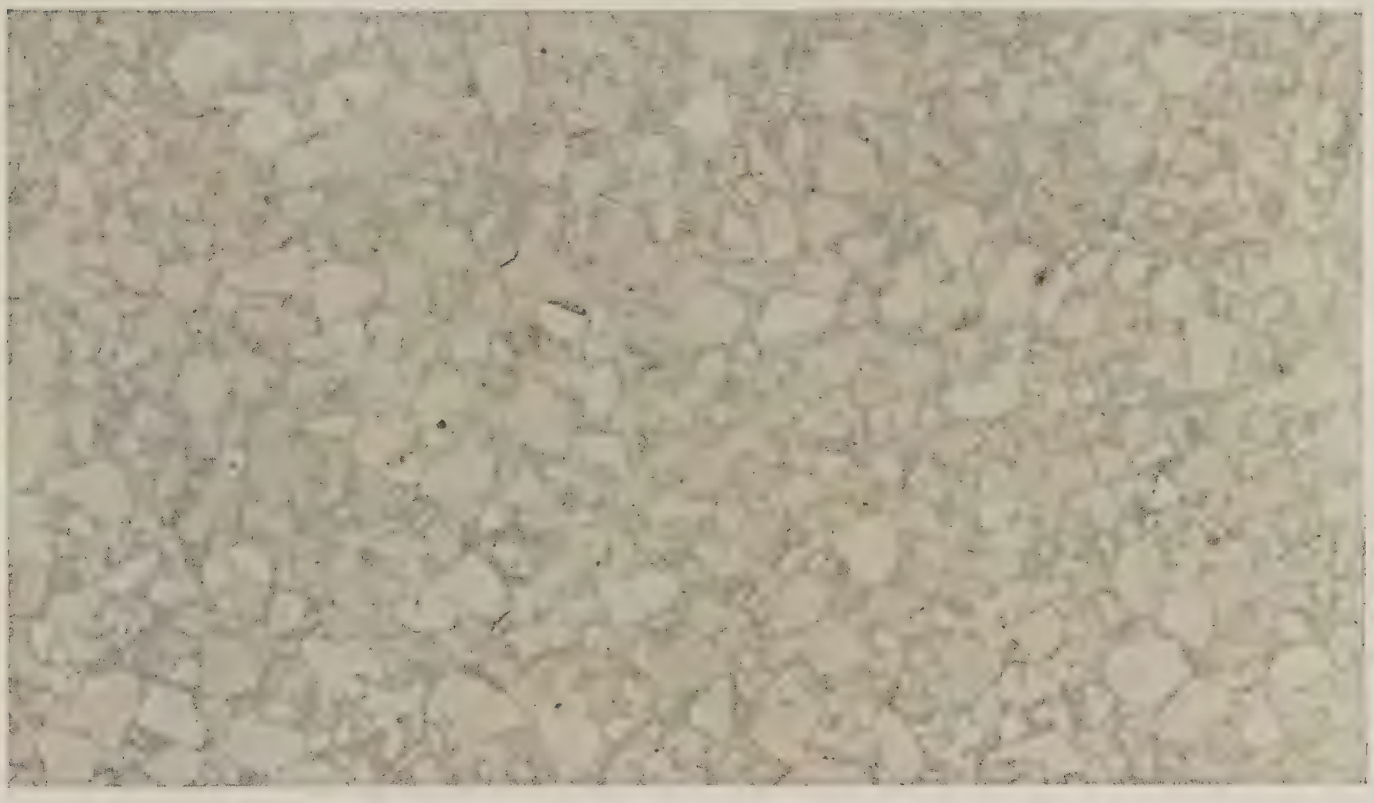

Plate 109

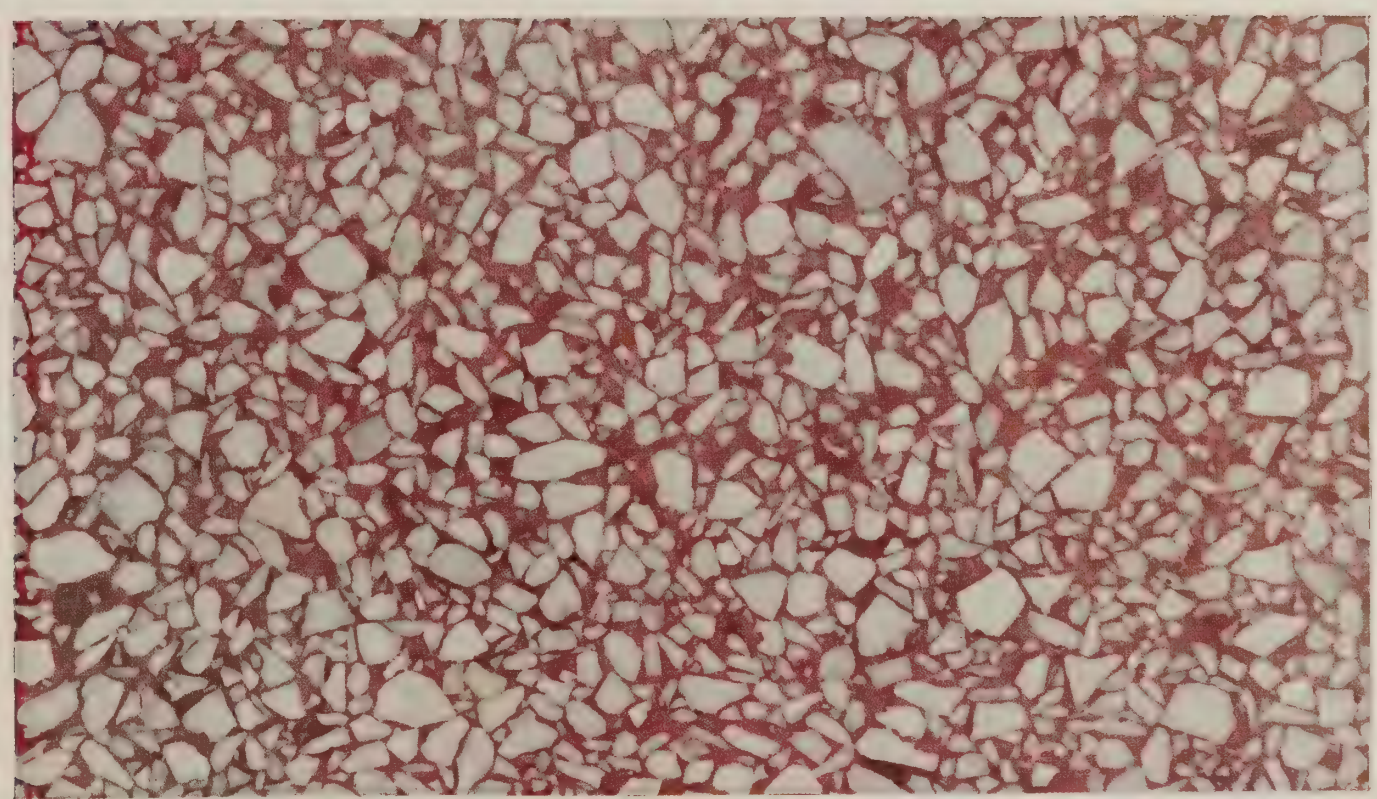

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Plate 112

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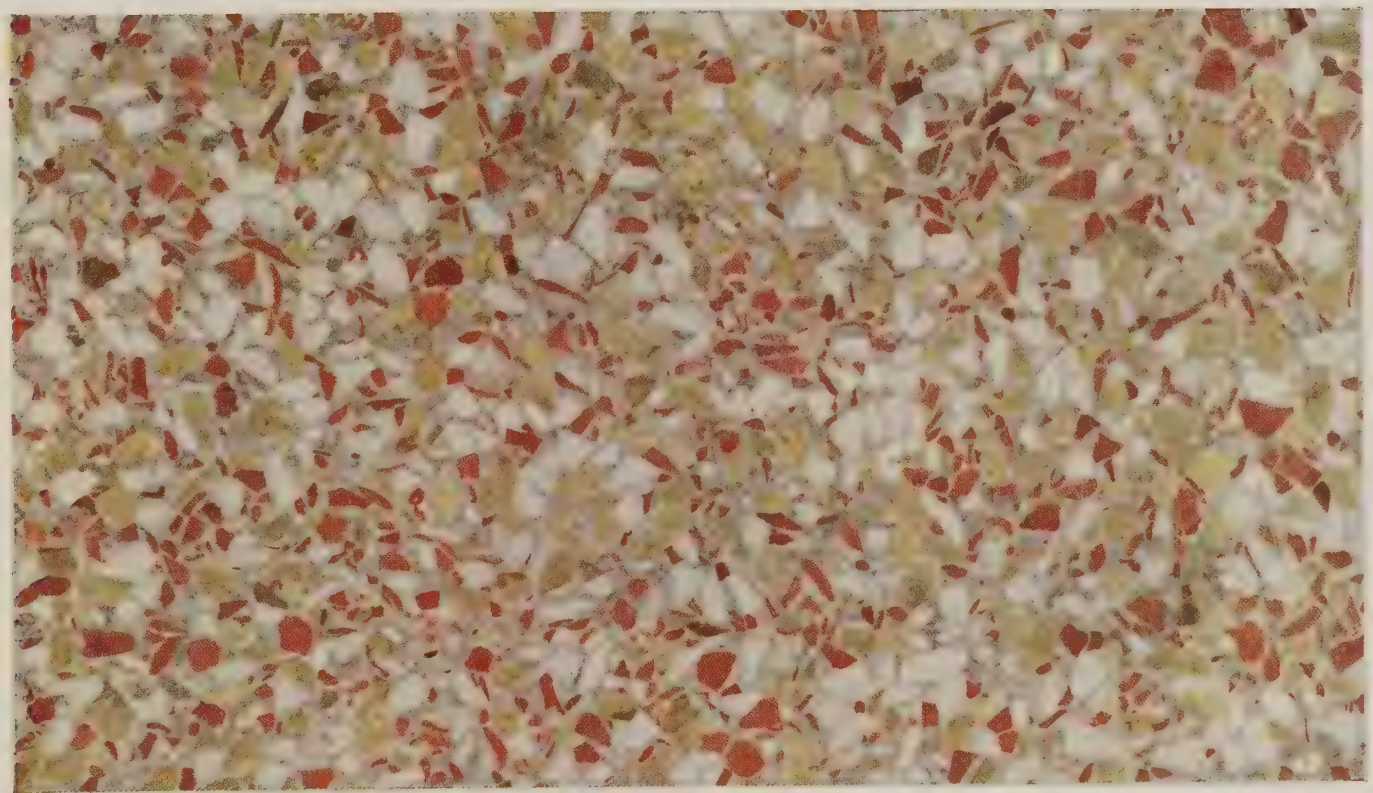

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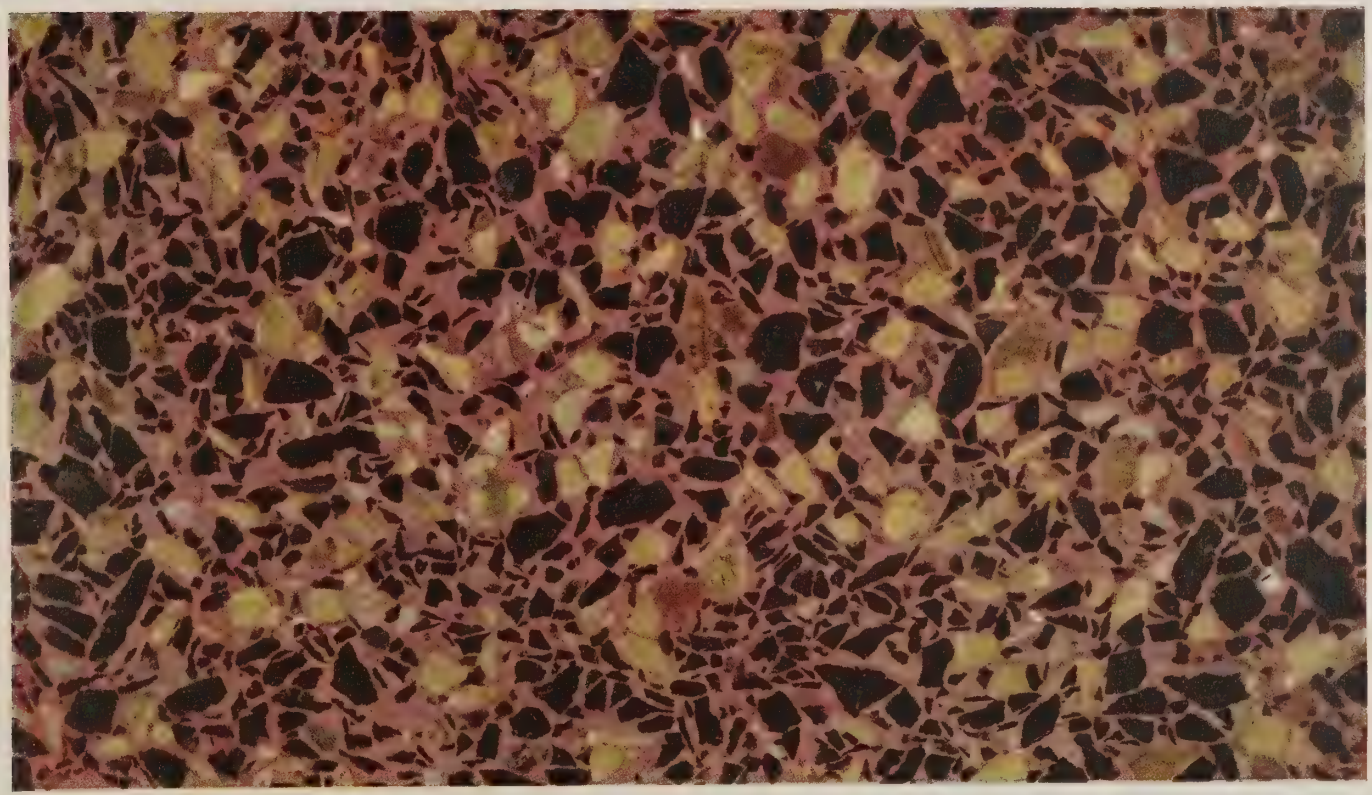

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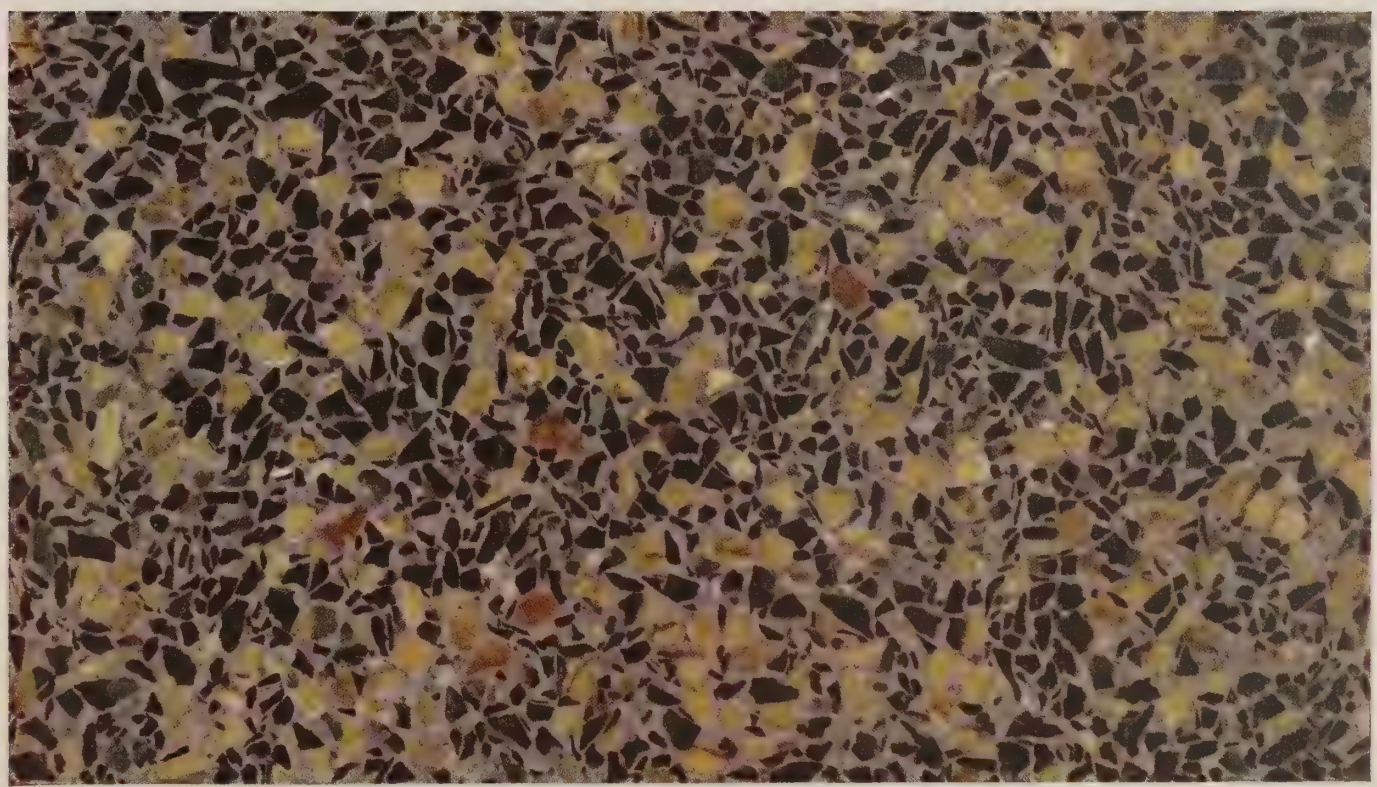

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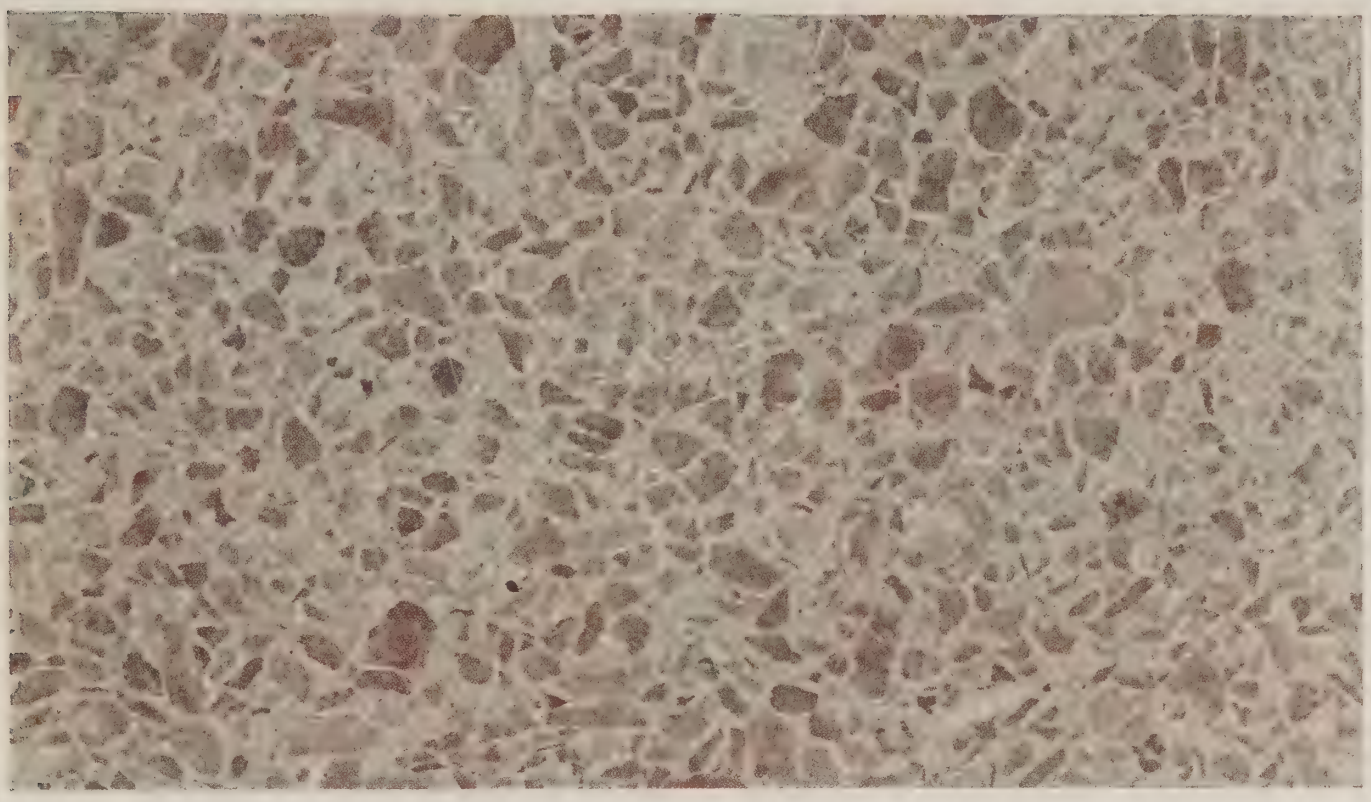
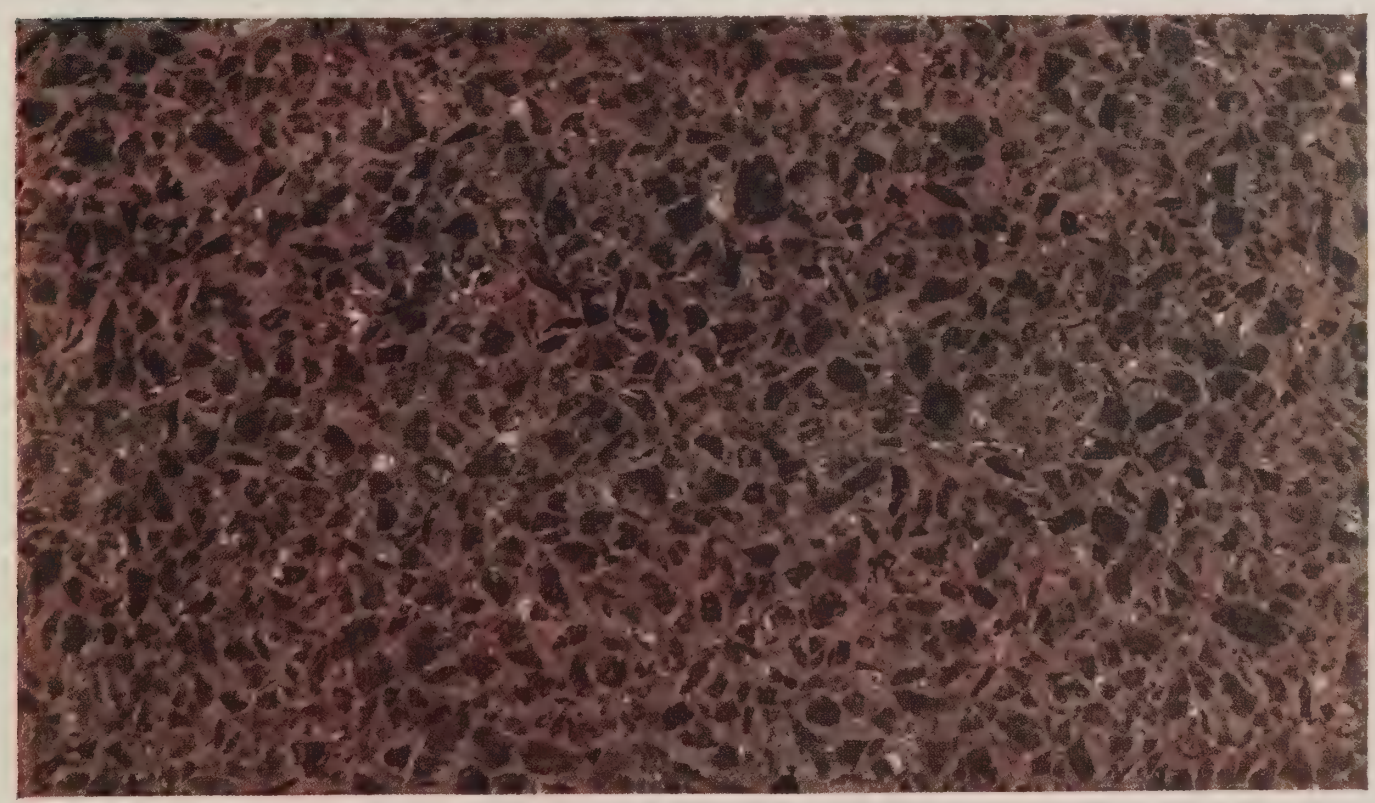


Plate 119



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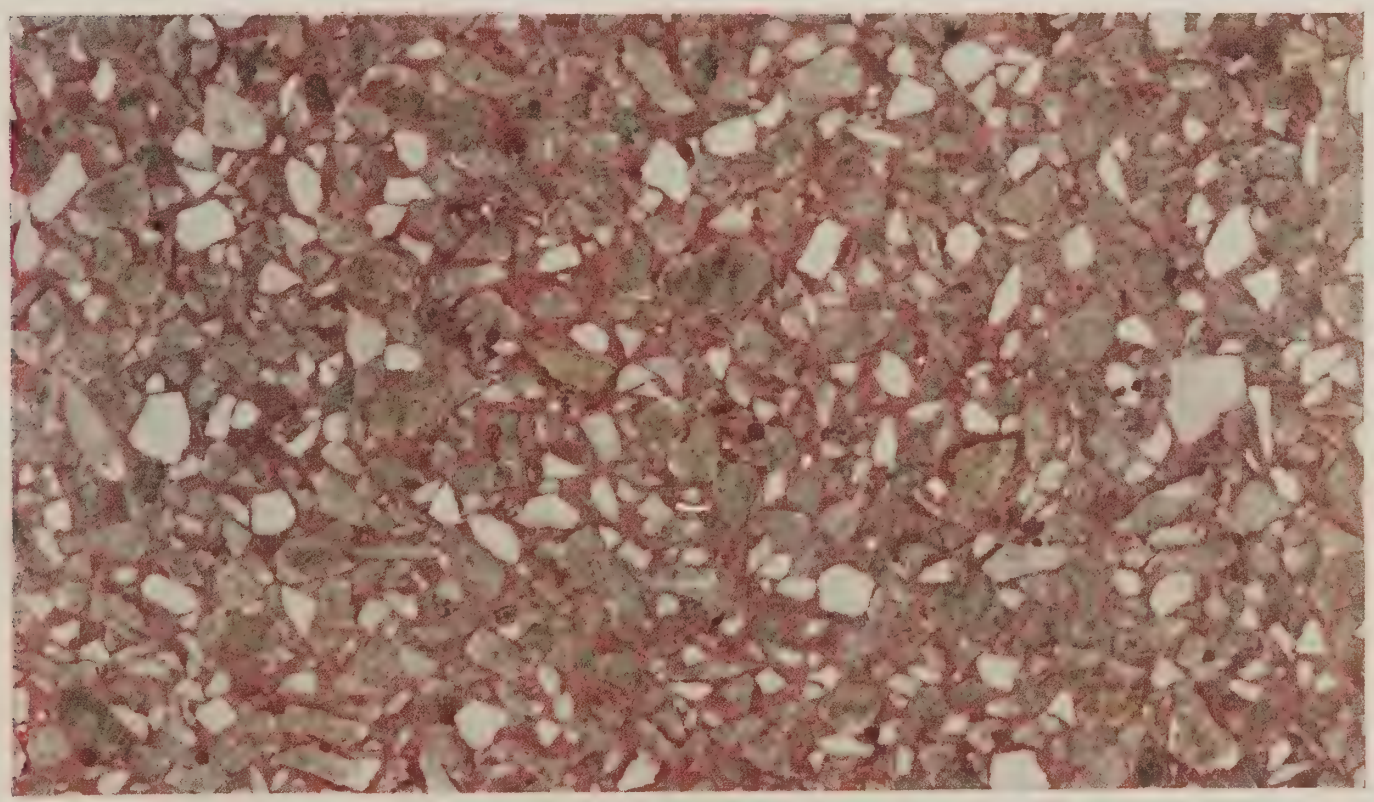

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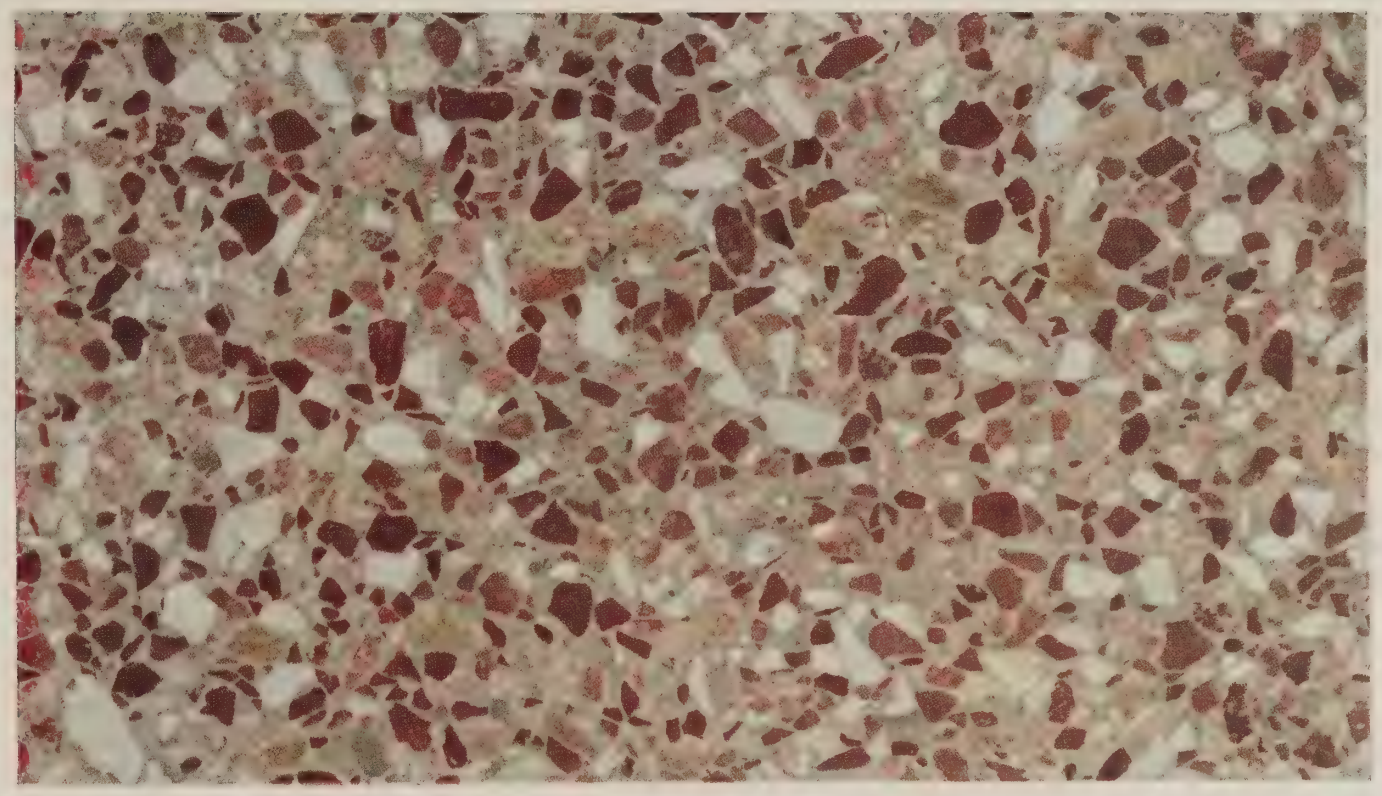

Plate 123

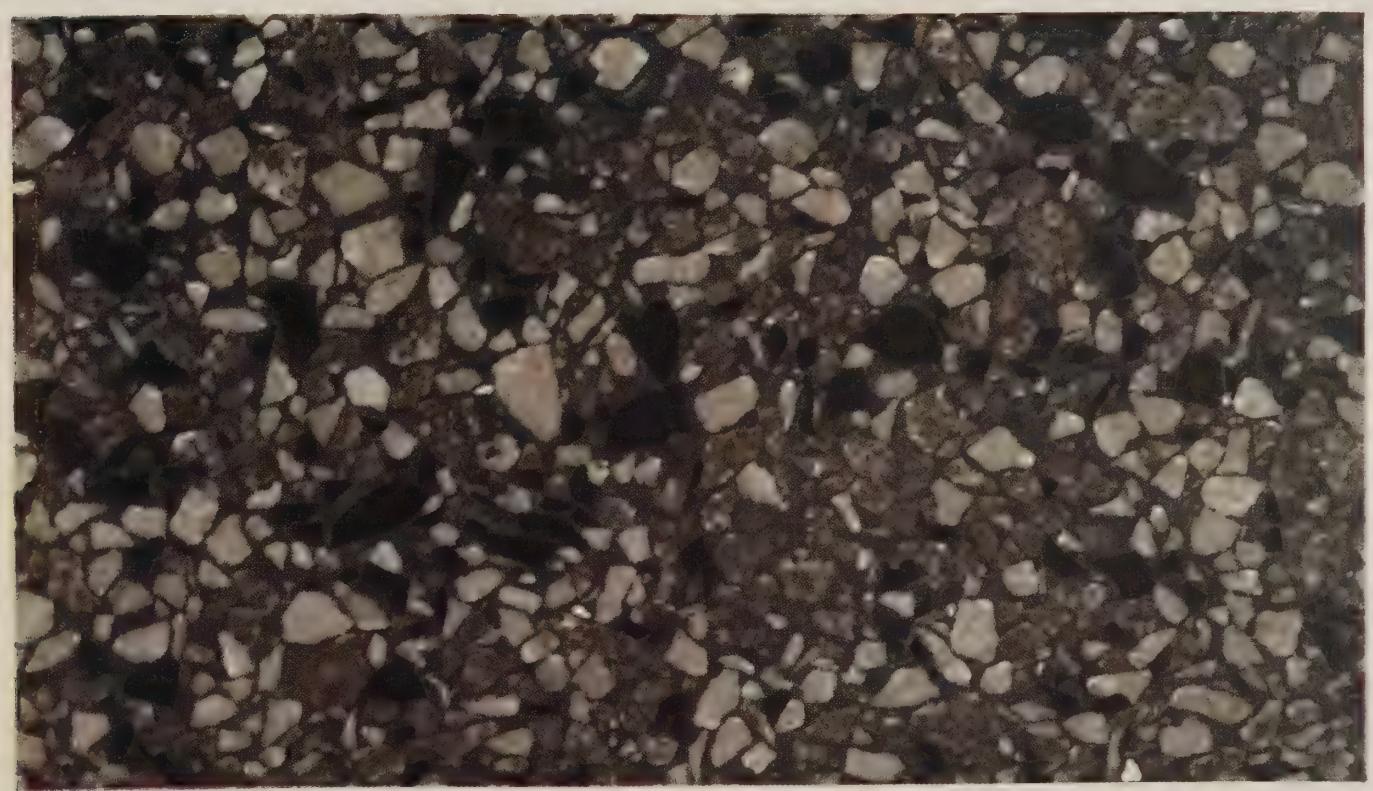

Plate 124

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grey cement

Five reasons

why you will want terrazzo

1. **Economy**—For Terrazzo, initial cost ***without*** replacements ***plus*** minimum upkeep costs over a period of years, usually is less than initial cost ***plus*** replacements and higher upkeep costs for other types of floors.

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INCORPORATED 1901
NEW JERSEY
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grey cement

Plate 125

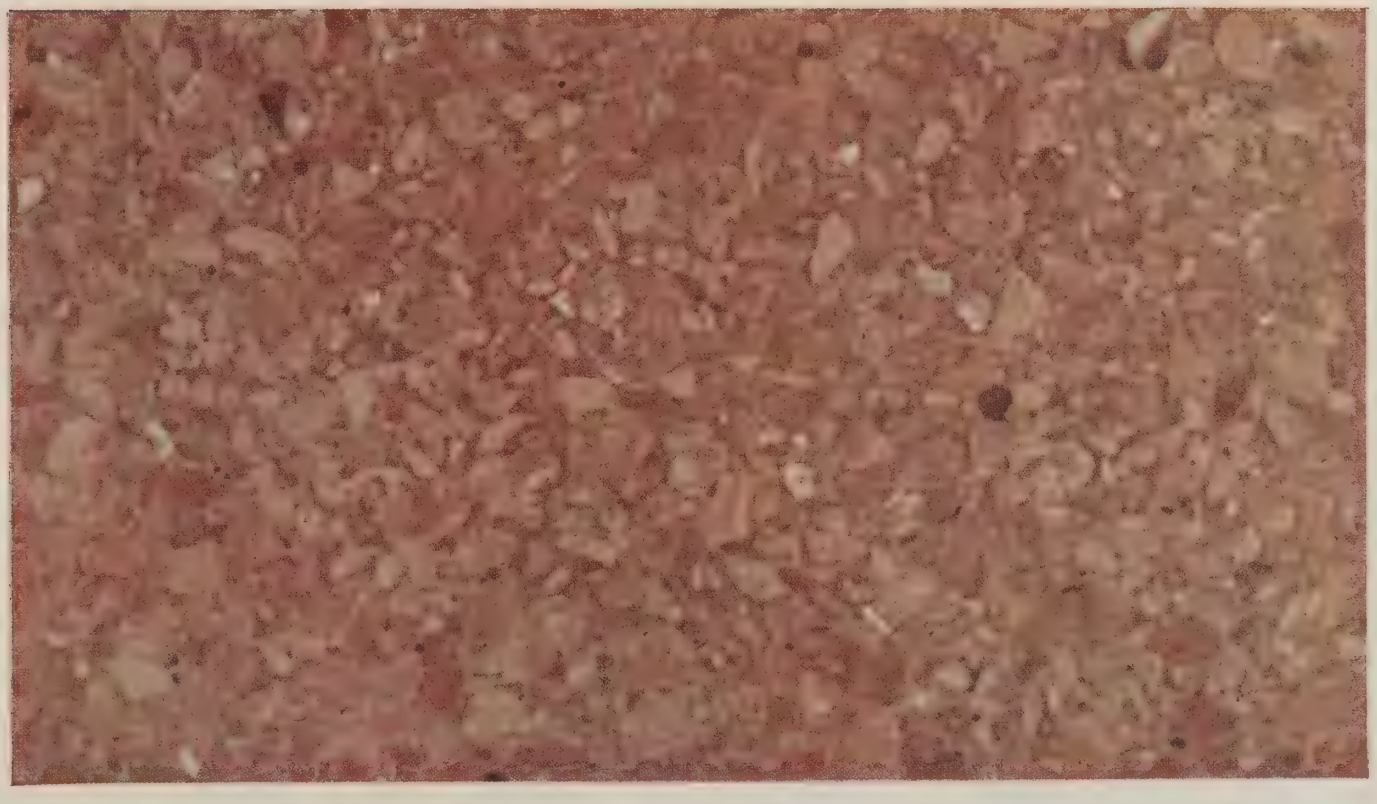

Plate 126

Copyright 1951

grey cement

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grey cement

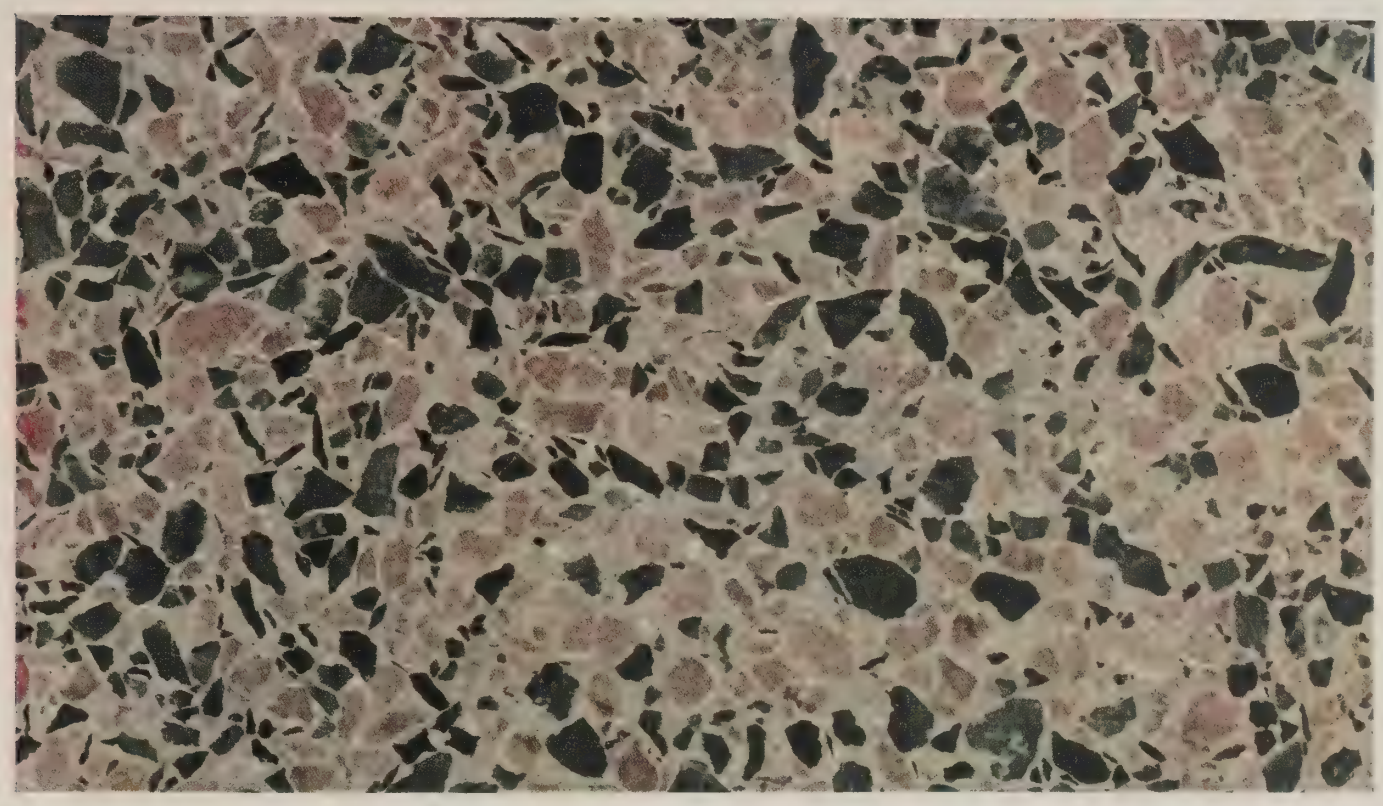

Plate 127

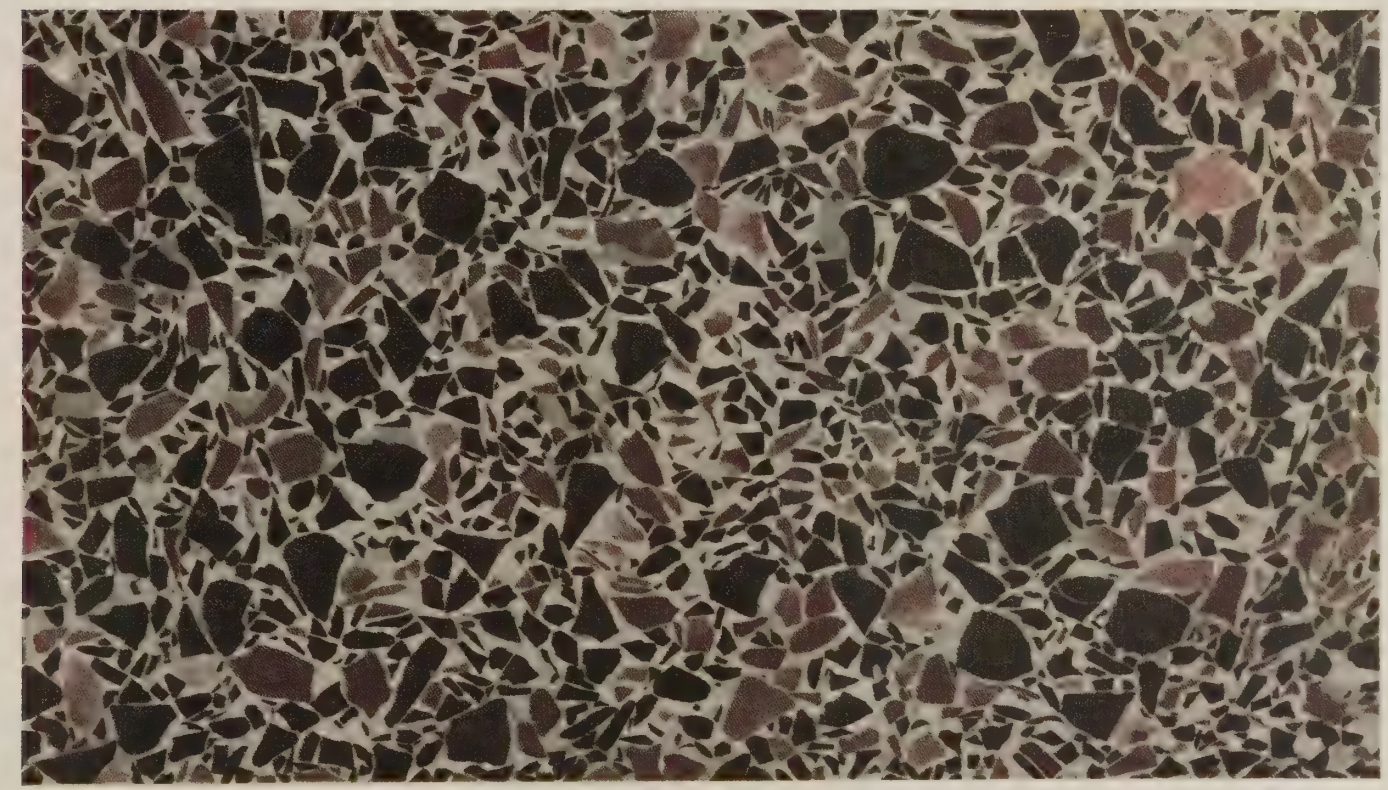

Plate 128

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grey cement

Five reasons

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grey cement

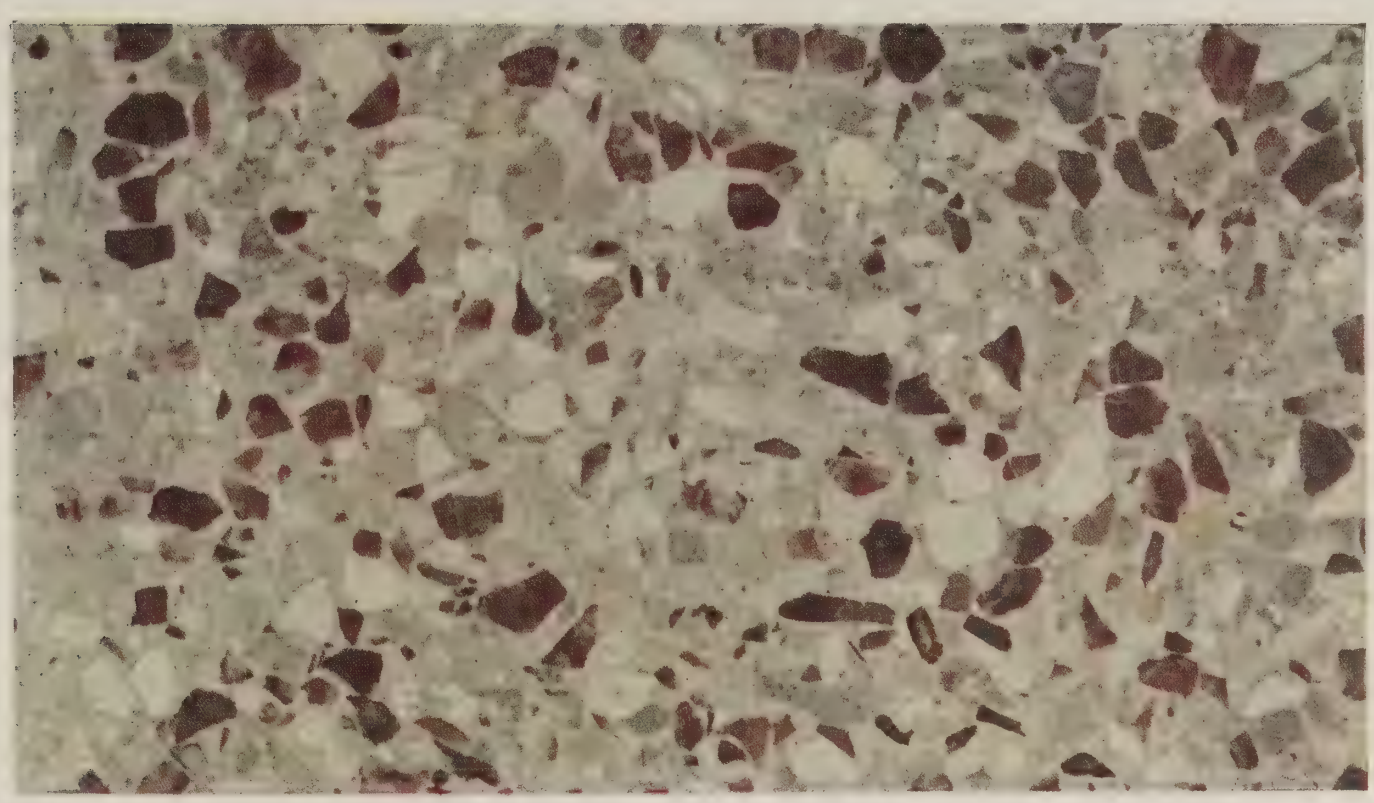

Plate 129

Plate 130

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grey cement

Five reasons

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grey cement

Plate 131

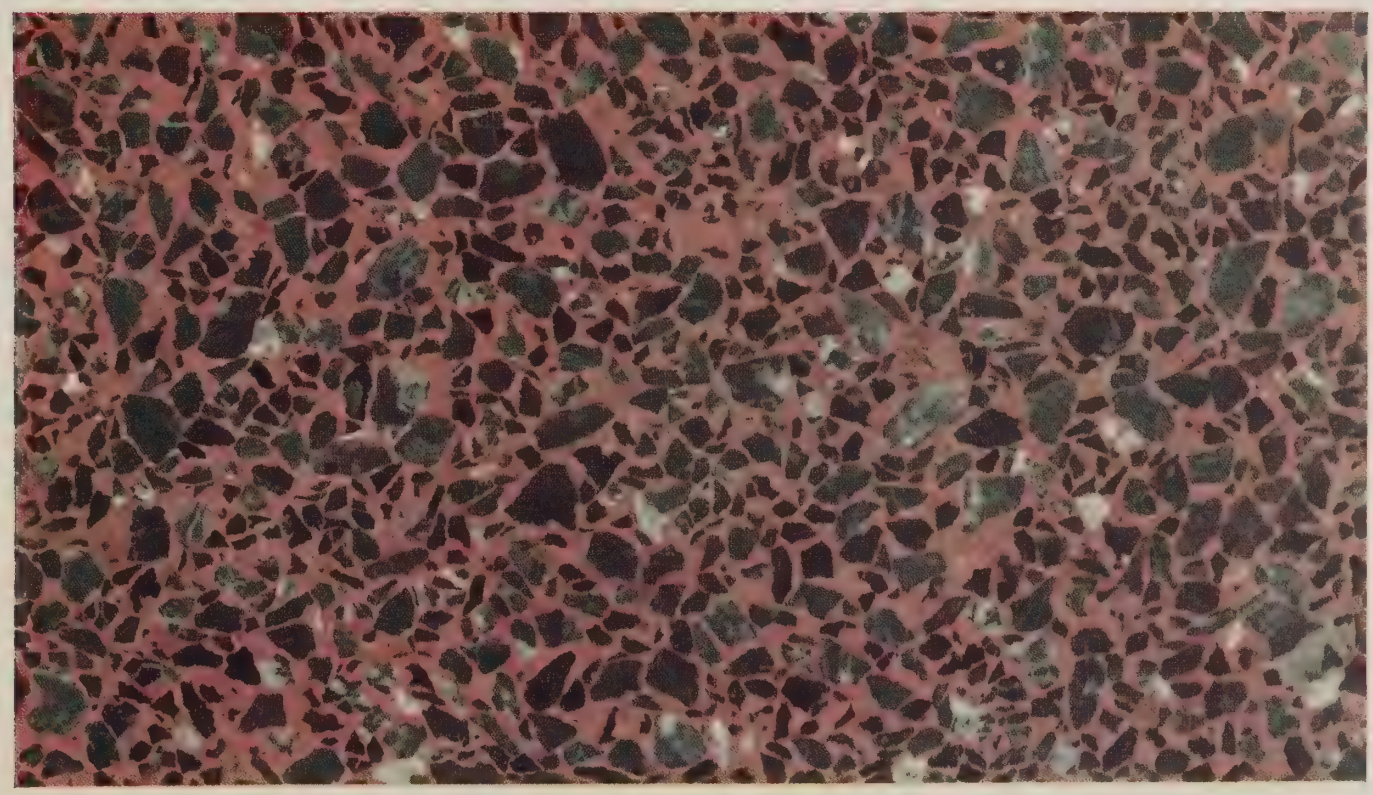

Plate 132

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Five reasons

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grey cement

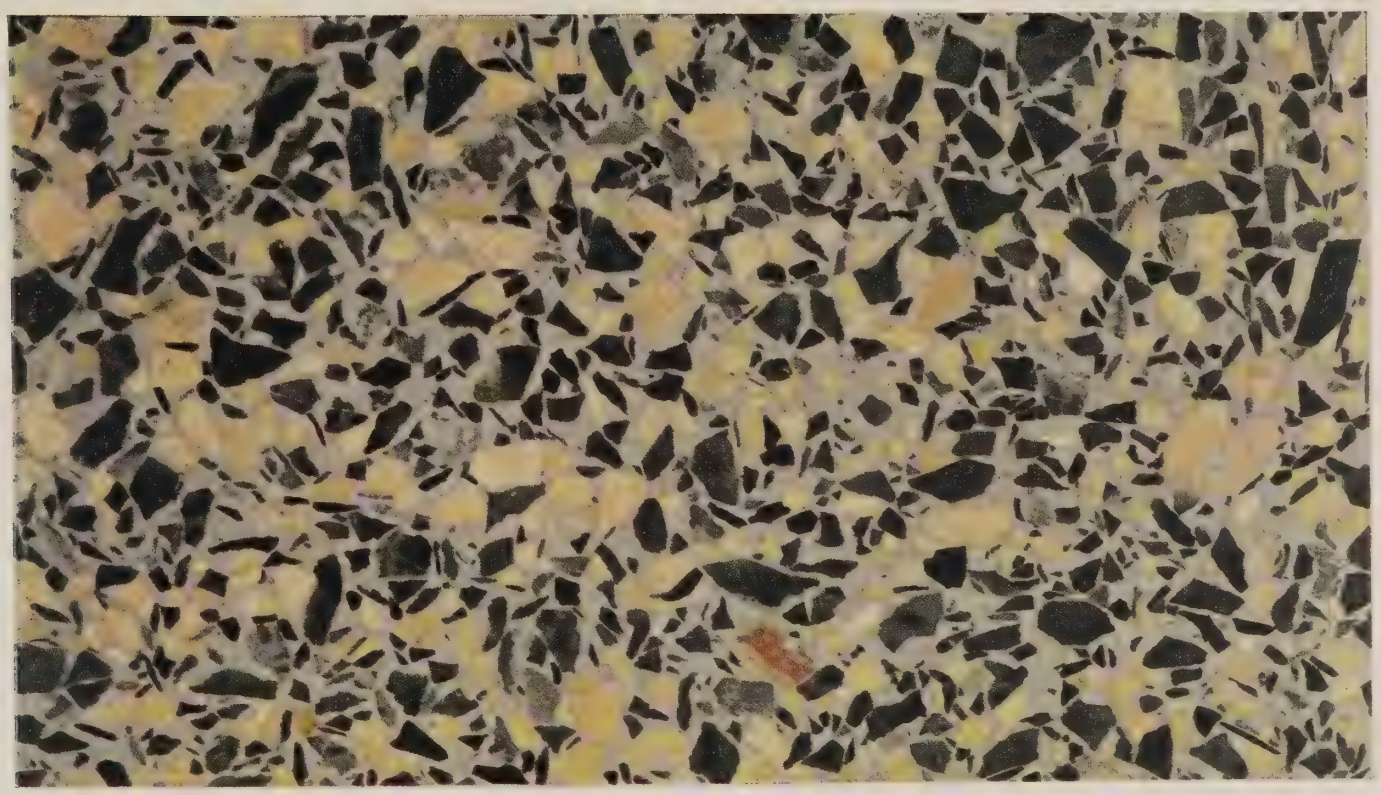

Plate 133

Plate 134

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grey cement

Five reasons

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grey cement

Plate 135

Plate 136

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Five reasons

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grey cement

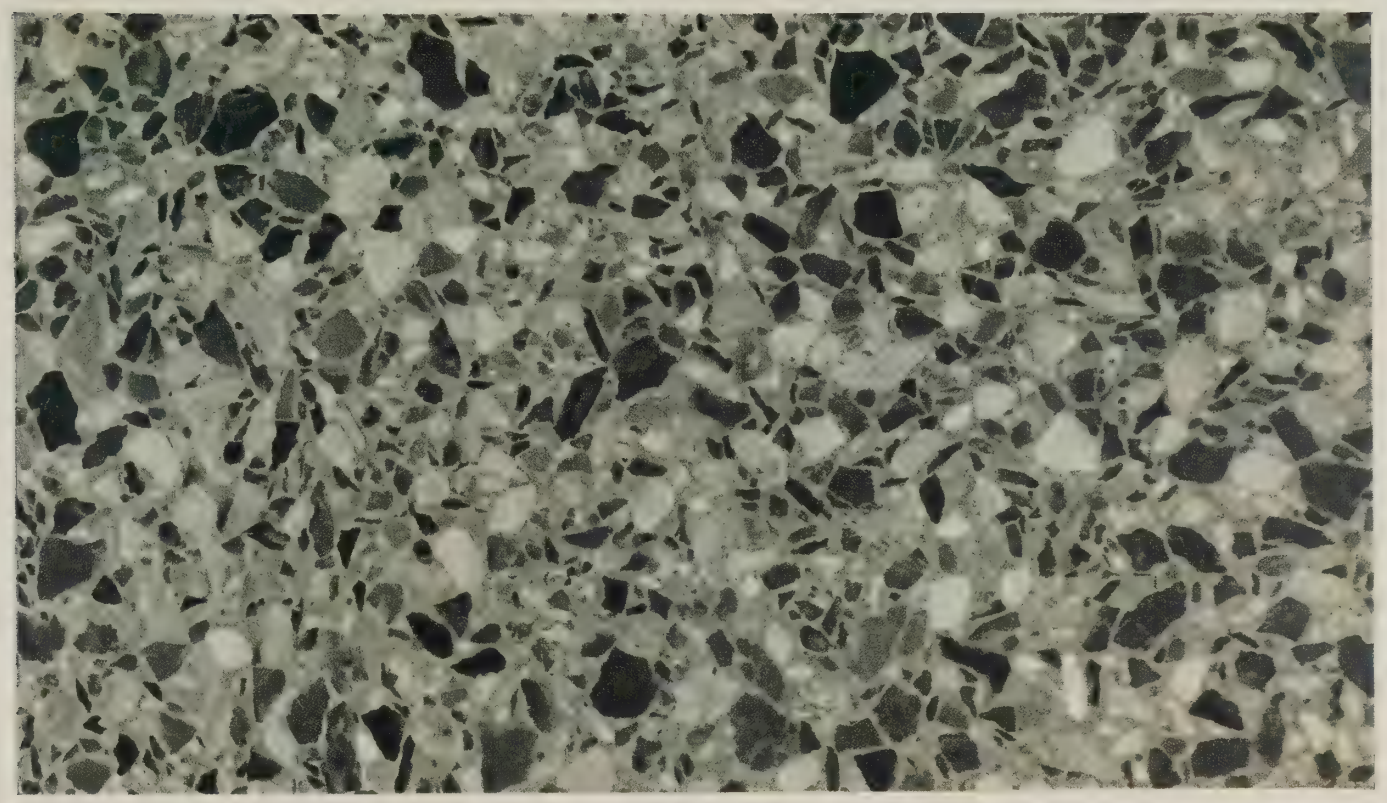

Plate 137

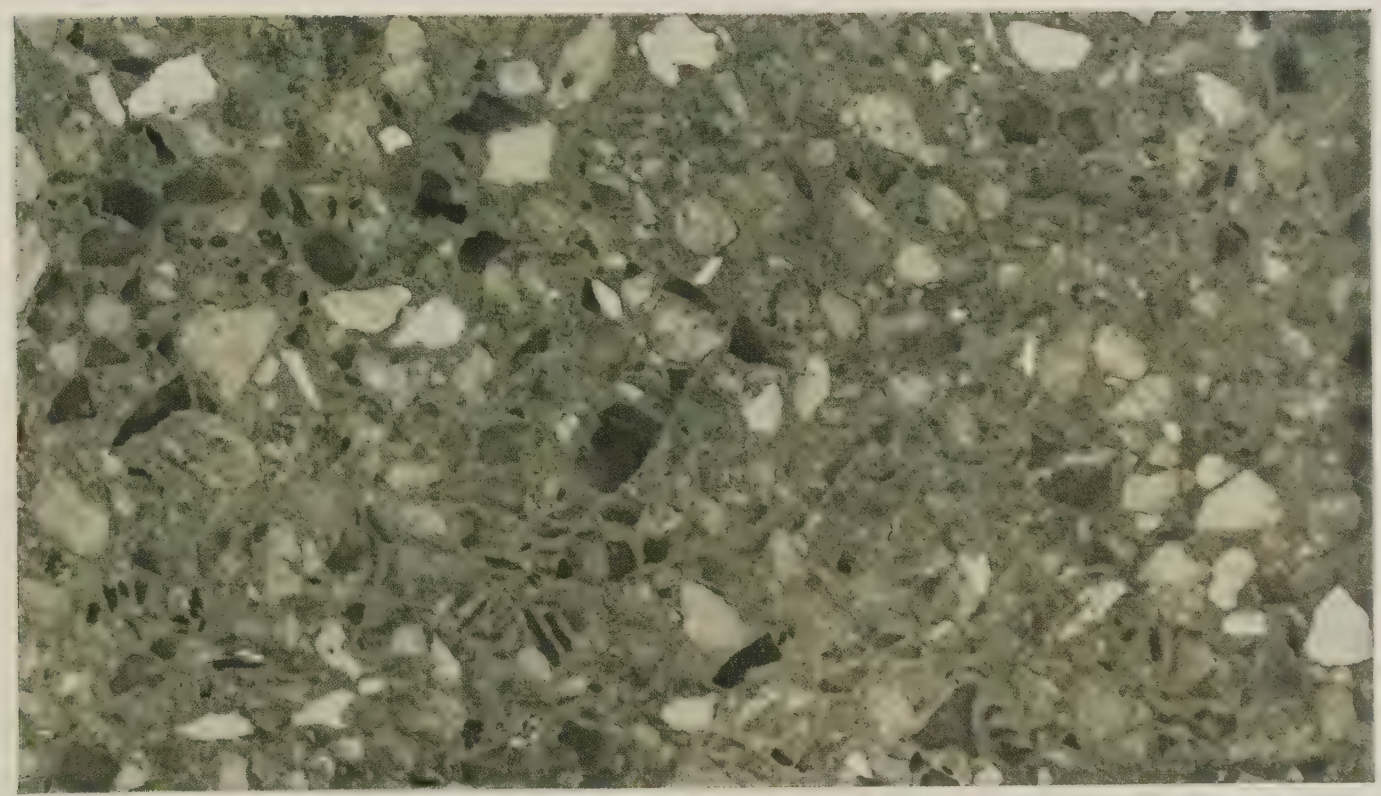

Plate 138

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Five reasons

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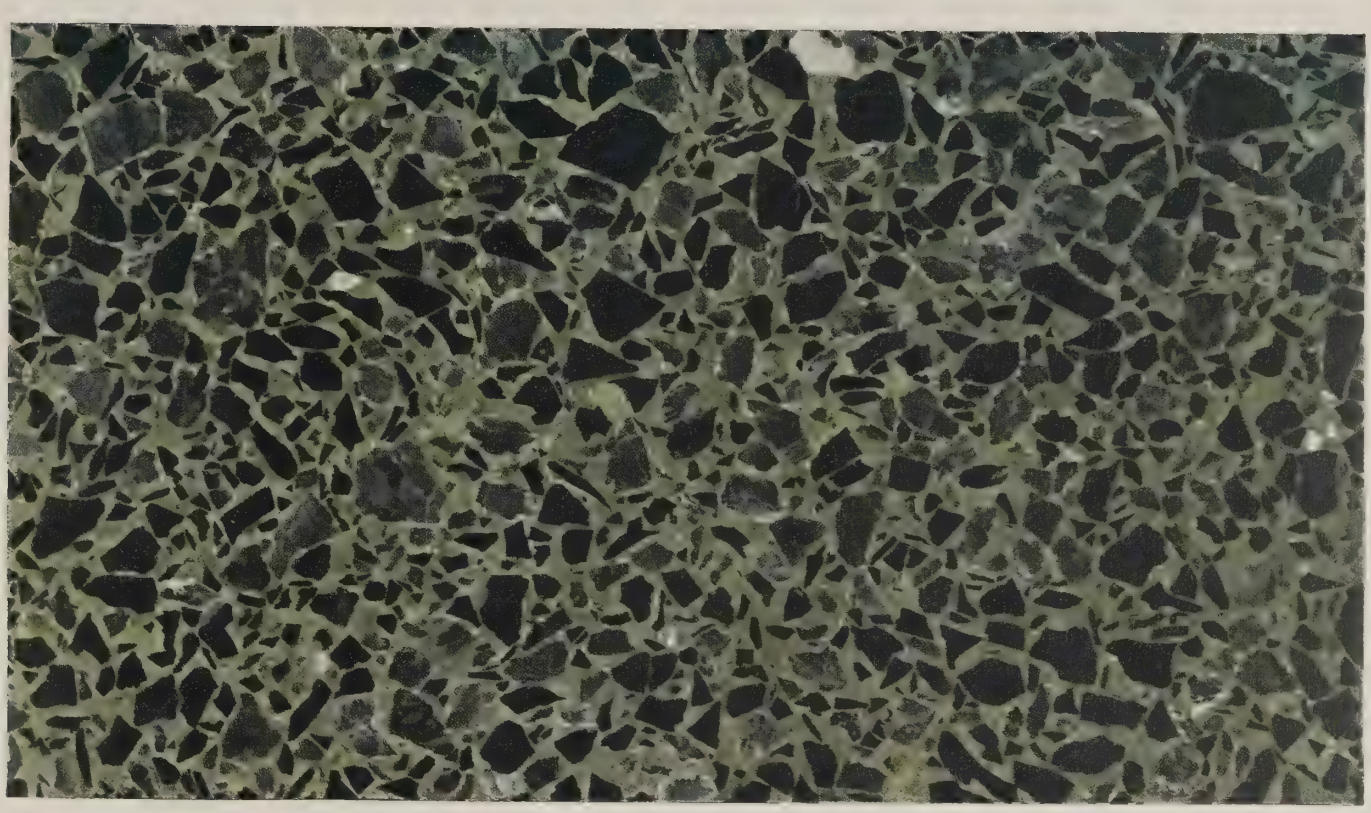

Plate 139

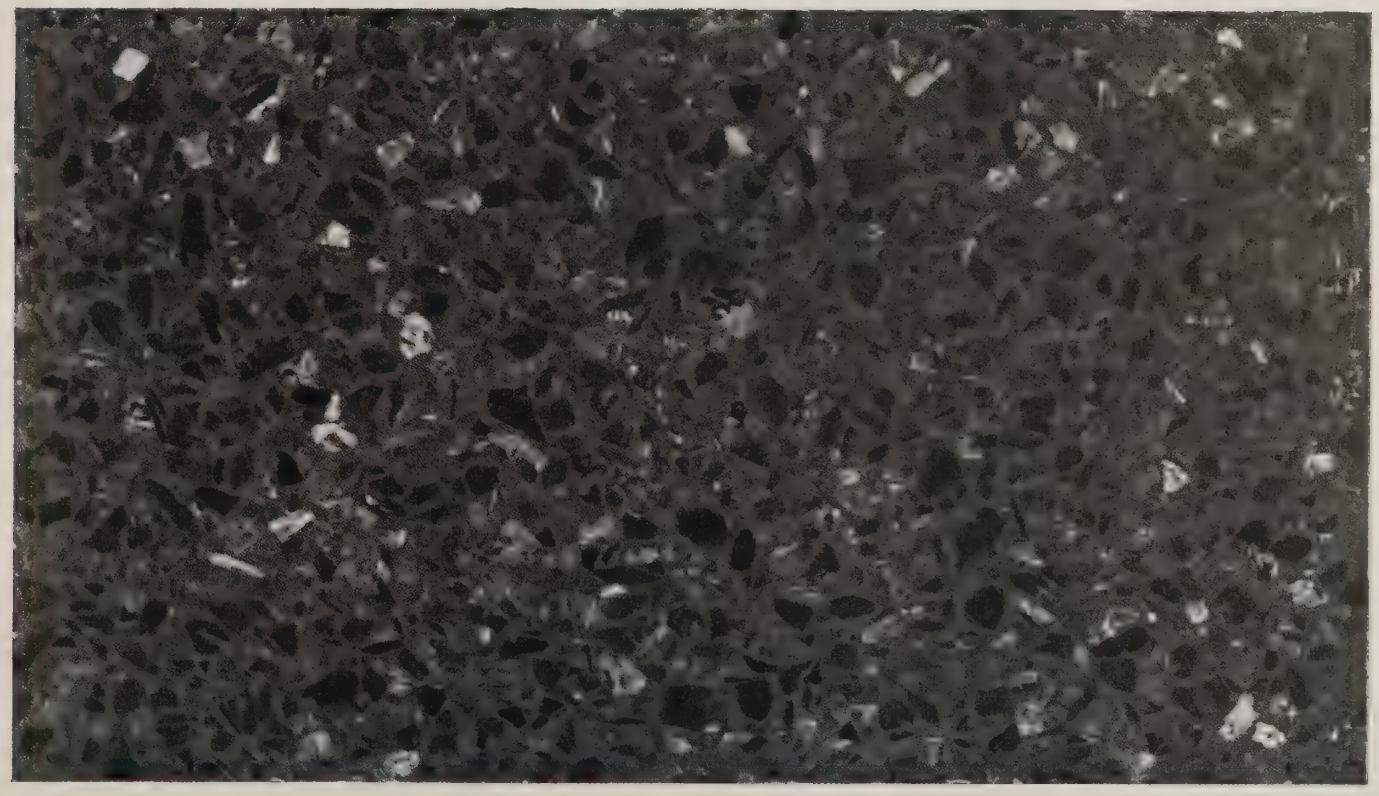

Plate 140

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Five reasons

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grey cement

Plate 141

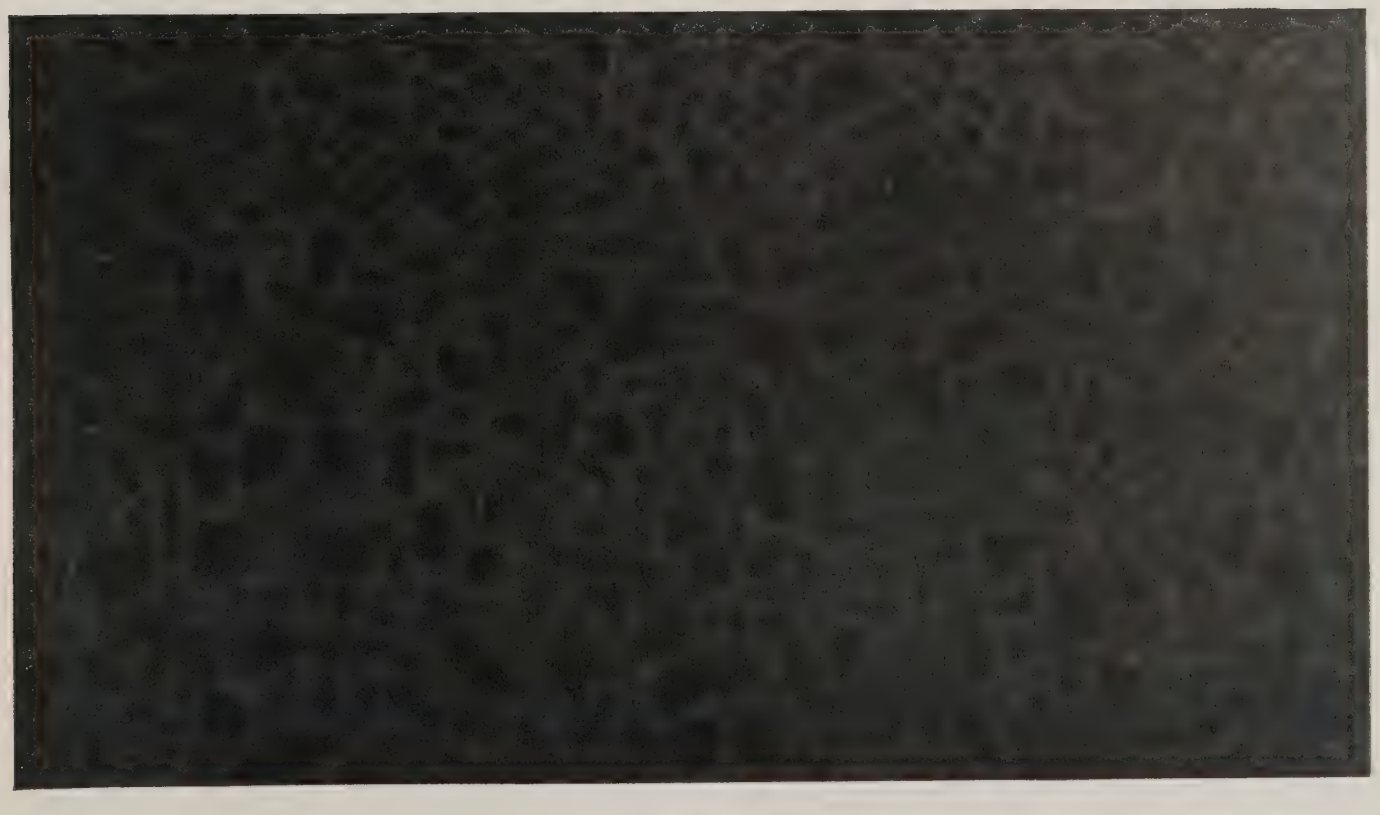

Plate 142

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grey cement

Five reasons

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white portland cement

terrazzo plates

The following pages illustrate sample plates, made with White Portland Cement. For lighter, brighter, richer shades of color, for pastel shades, for blending harmoniously with general decorative schemes, white cement is generously used in the Terrazzo Industry.

White Portland Cement has a slightly faster initial setting trend than grey Portland Cement, but in all other respects it has all the properties and attains the same eventual hardness and durability.

White Portland Cement meets the same Federal and American Society Testing Material specifications, as grey Portland Cement. Portland Cement is the one and only material that goes into the construction of a building, that does not deteriorate. In fact, it has a continuous trend of constantly improving as it ages, becoming harder and more impervious as the years go by.

White Portland Cement Terrazzo floors, as well as other Terrazzo work, made from white cement, will always have a clean, sparkling, fresh appearance. Easy to keep clean and most economical to maintain.

An unusual store front made of precast terrazzo panels.

white cement

Plate 200

Plate 201

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white cement

Five reasons

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white cement

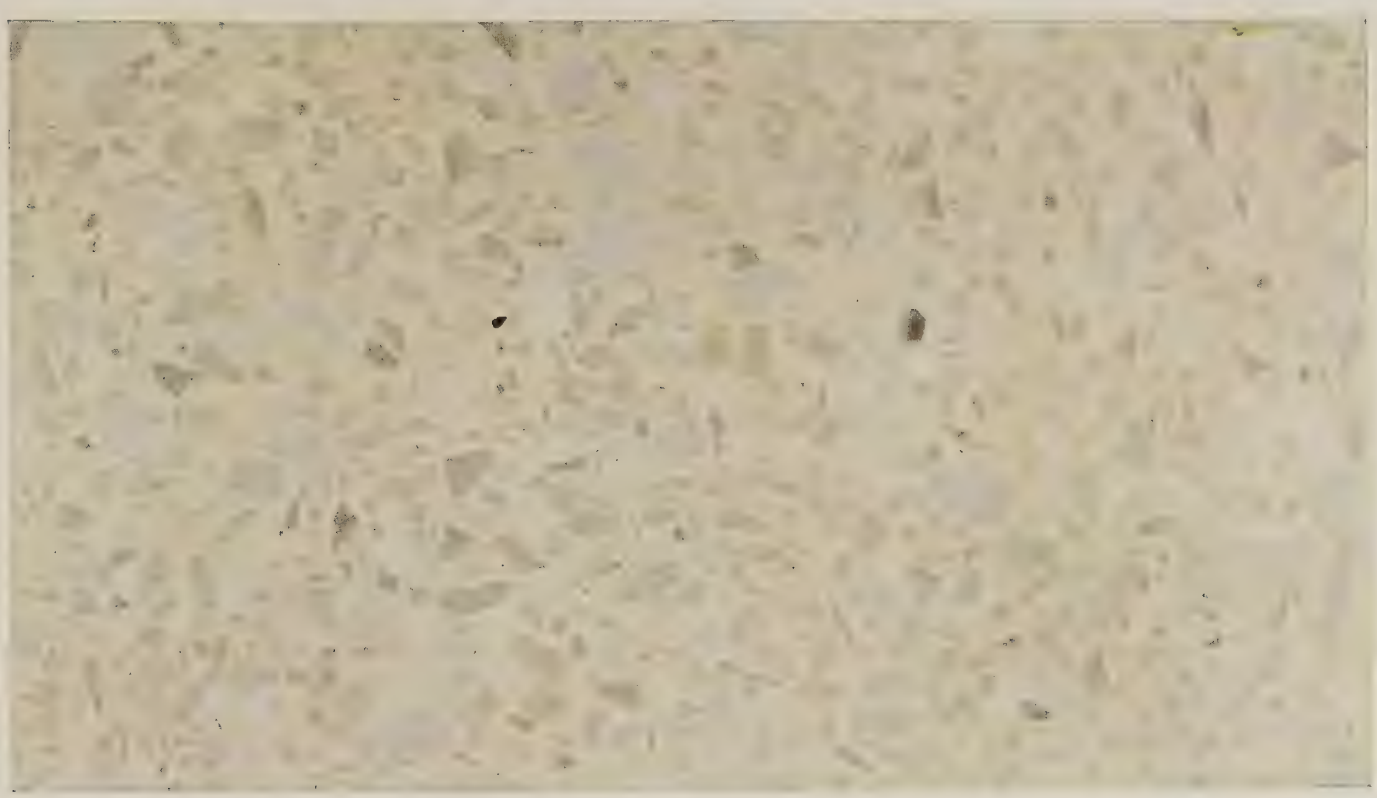

Plate 202

Plate 203

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white cement

Five reasons

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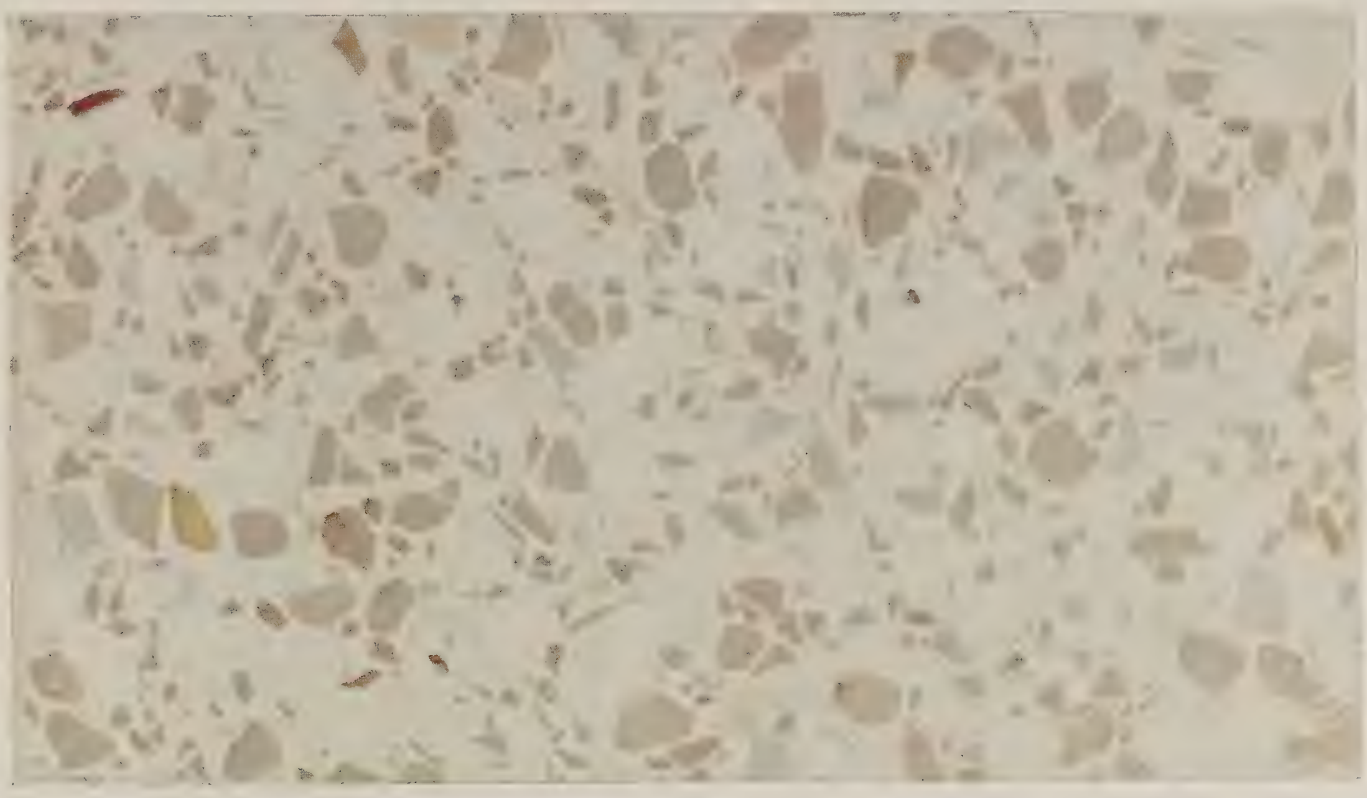

Plate 204

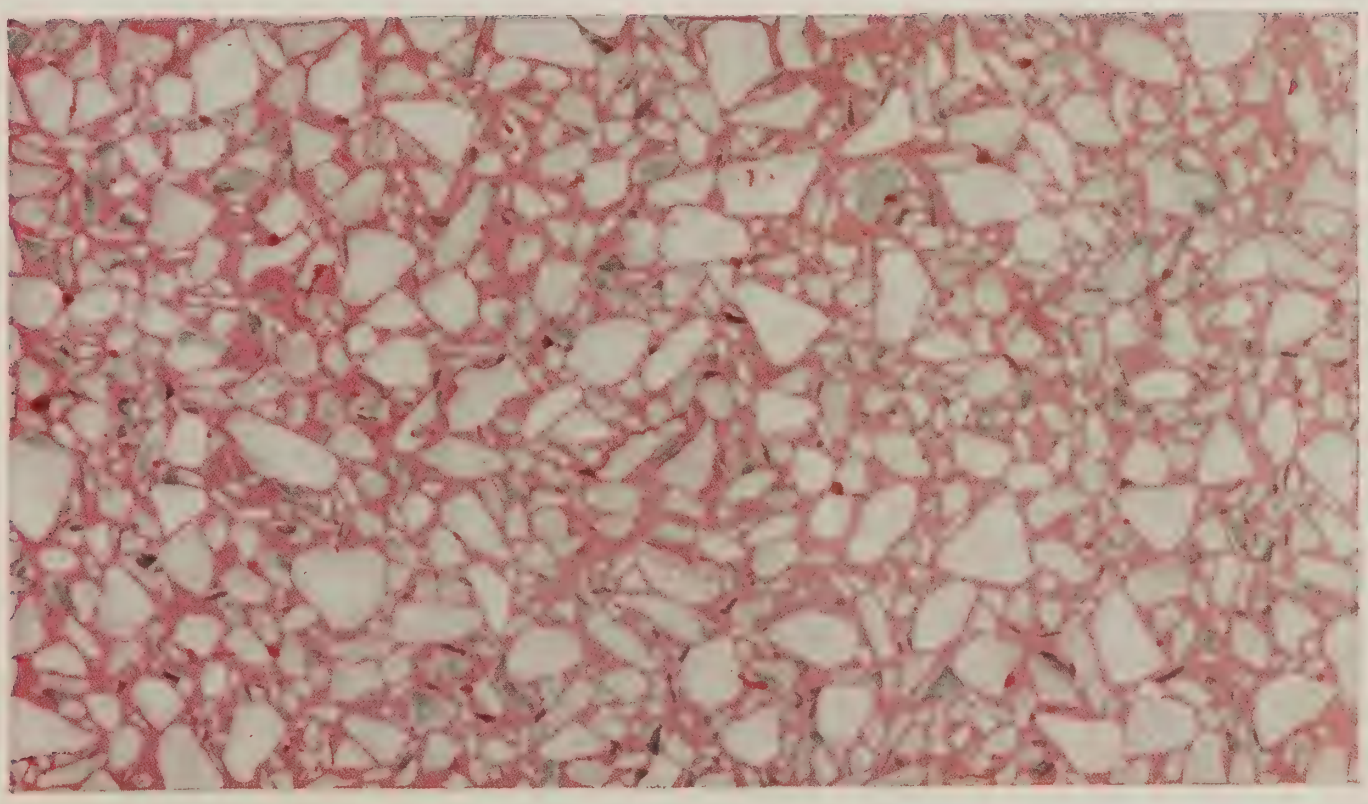

Plate 205

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white cement

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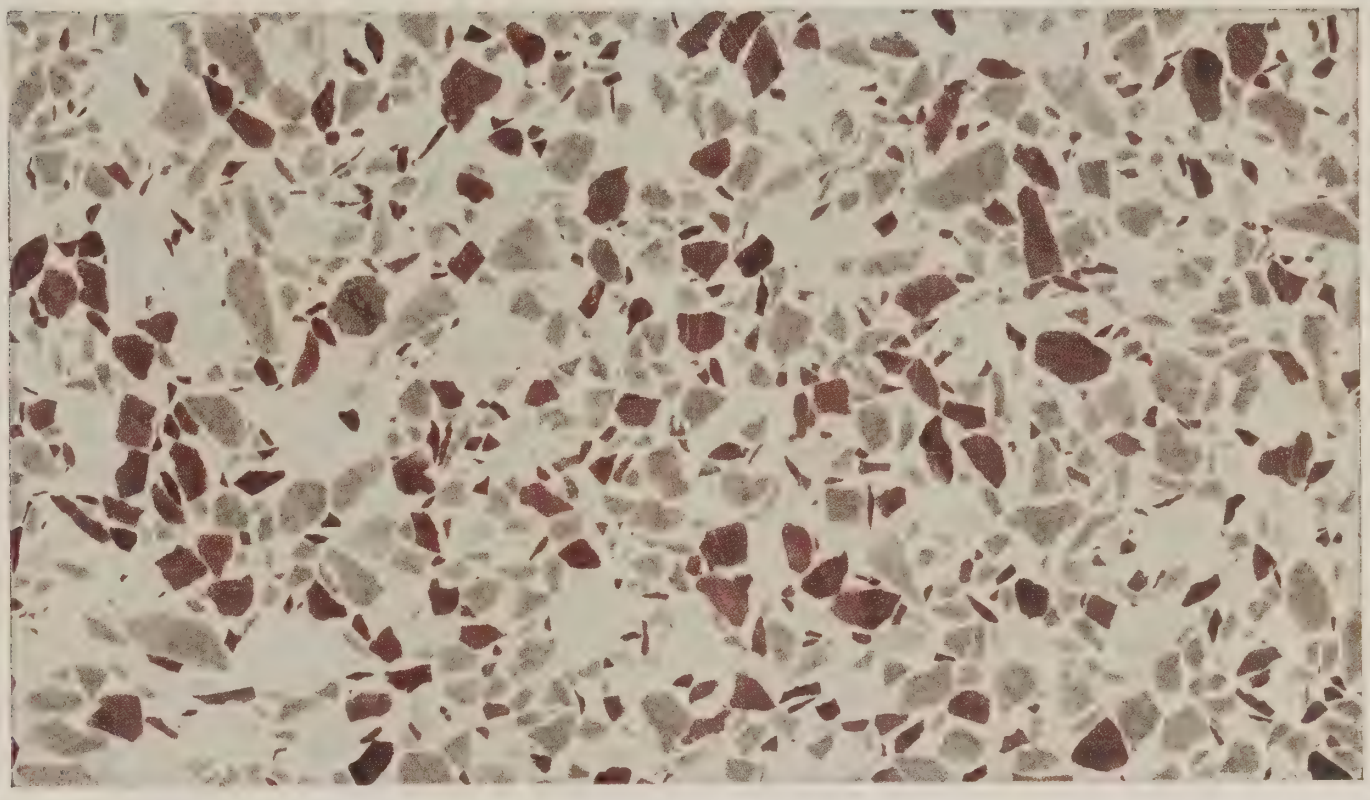

Plate 206

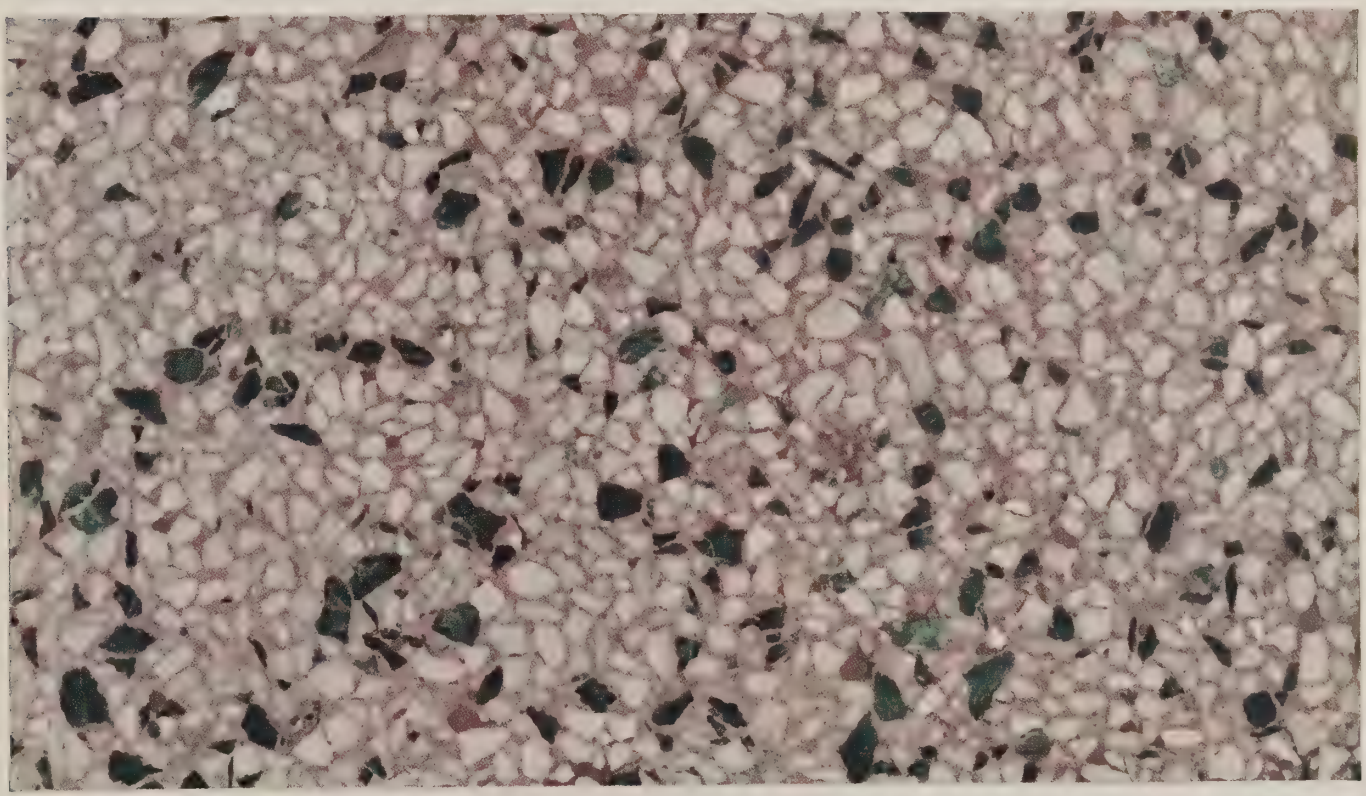

Plate 207

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white cement

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white cement

Plate 208

Plate 209

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Five reasons

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white cement

Plate 210

Plate 211

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white cement

Plate 212

Plate 213

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white cement

Five reasons

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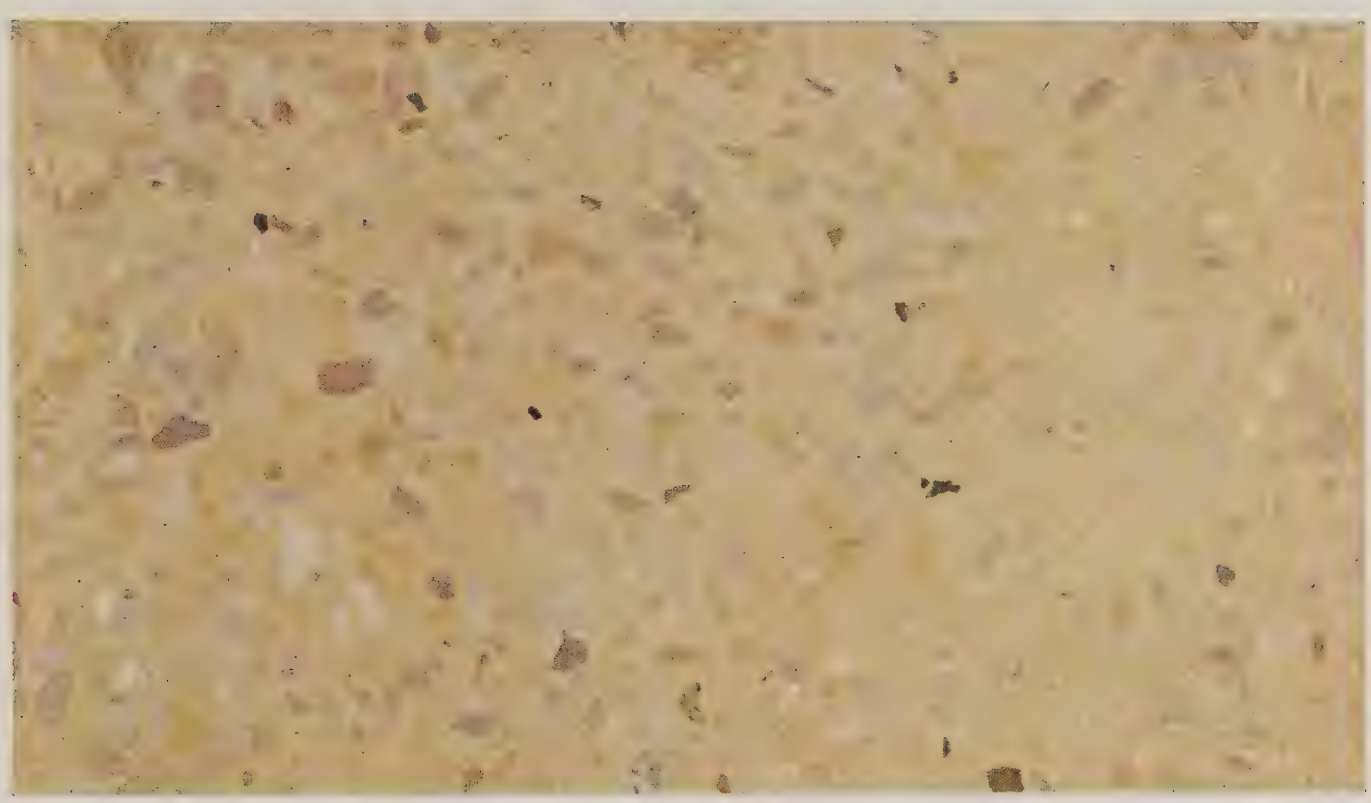

Plate 214

Plate 215

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Five reasons

why you will want terrazzo

1. **Economy**—For Terrazzo, initial cost *without* replacements *plus* minimum upkeep costs over a period of years, usually is less than initial cost *plus* replacements and higher upkeep costs for other types of floors.

2. **Comfort**—Finished Terrazzo is *easy to walk on.* It is inherently non-slip in nature and provides a safe walkway surface.

3. **Cleanliness**—Terrazzo has a smooth, jointless surface which *cleans easily,* and thus is sanitary and aseptic. It can be sealed so as to be practically non-absorbent.

4. **Color and Design**—Terrazzo has warmth and beauty. You may specify *any design* you wish—pictorial or geometric—in virtually *any combination of colors.*

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Plate 216

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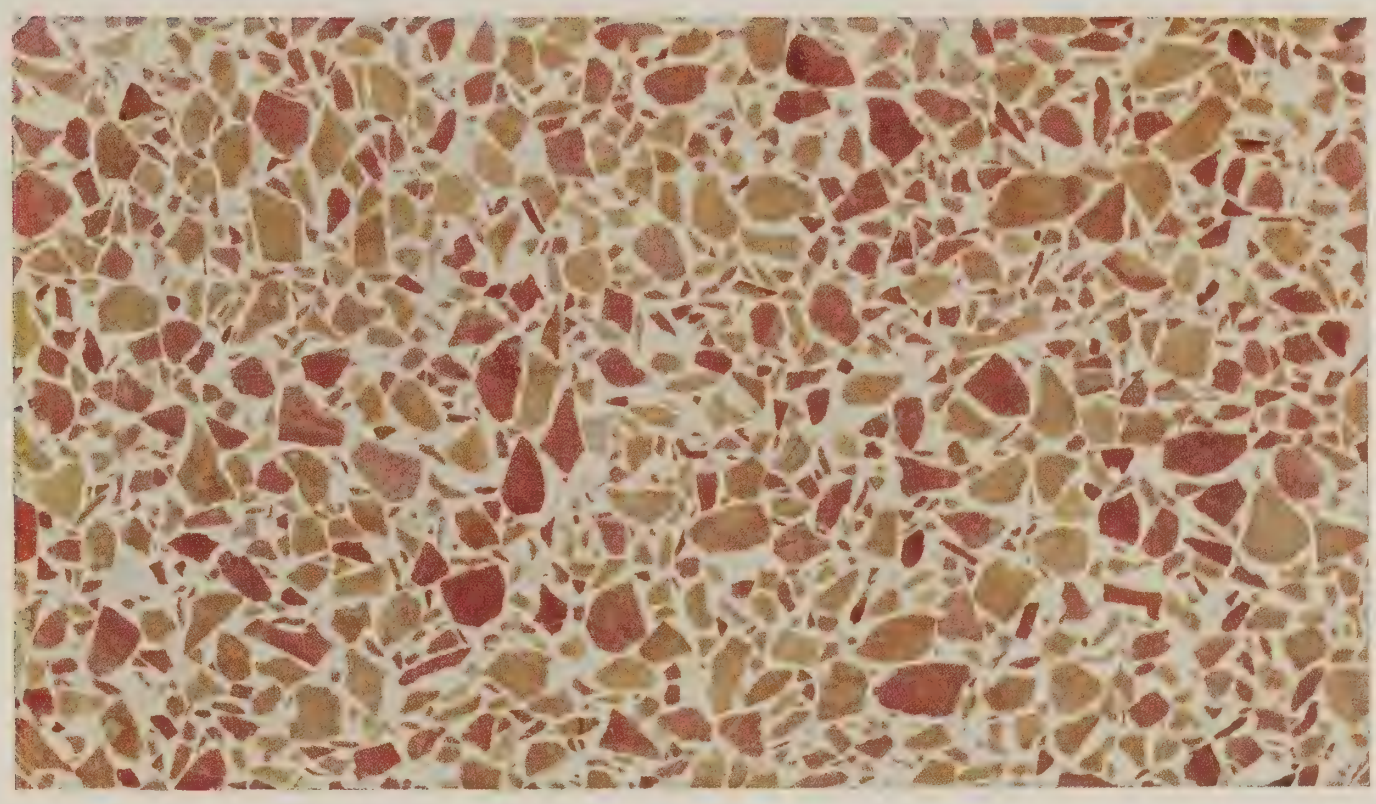

Plate 218

Plate 219

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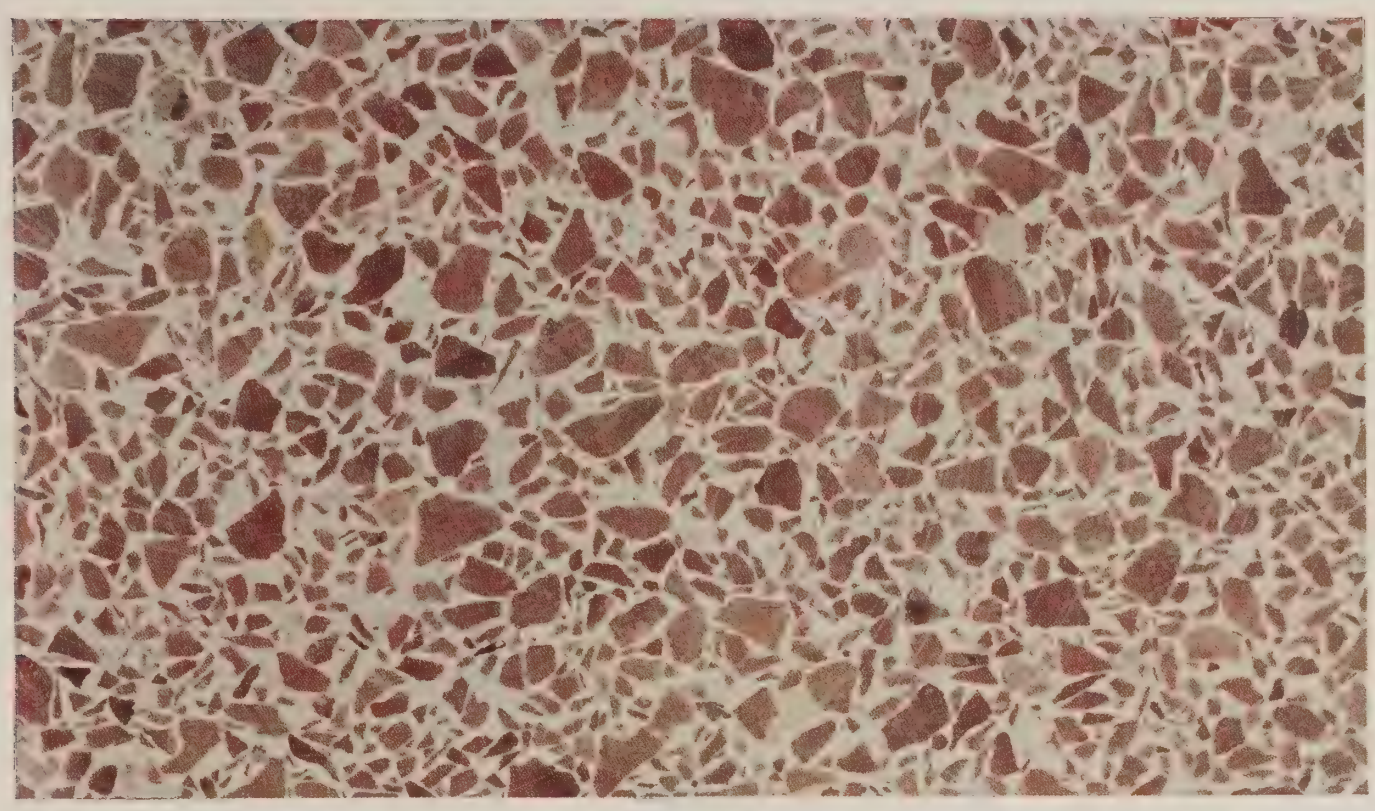
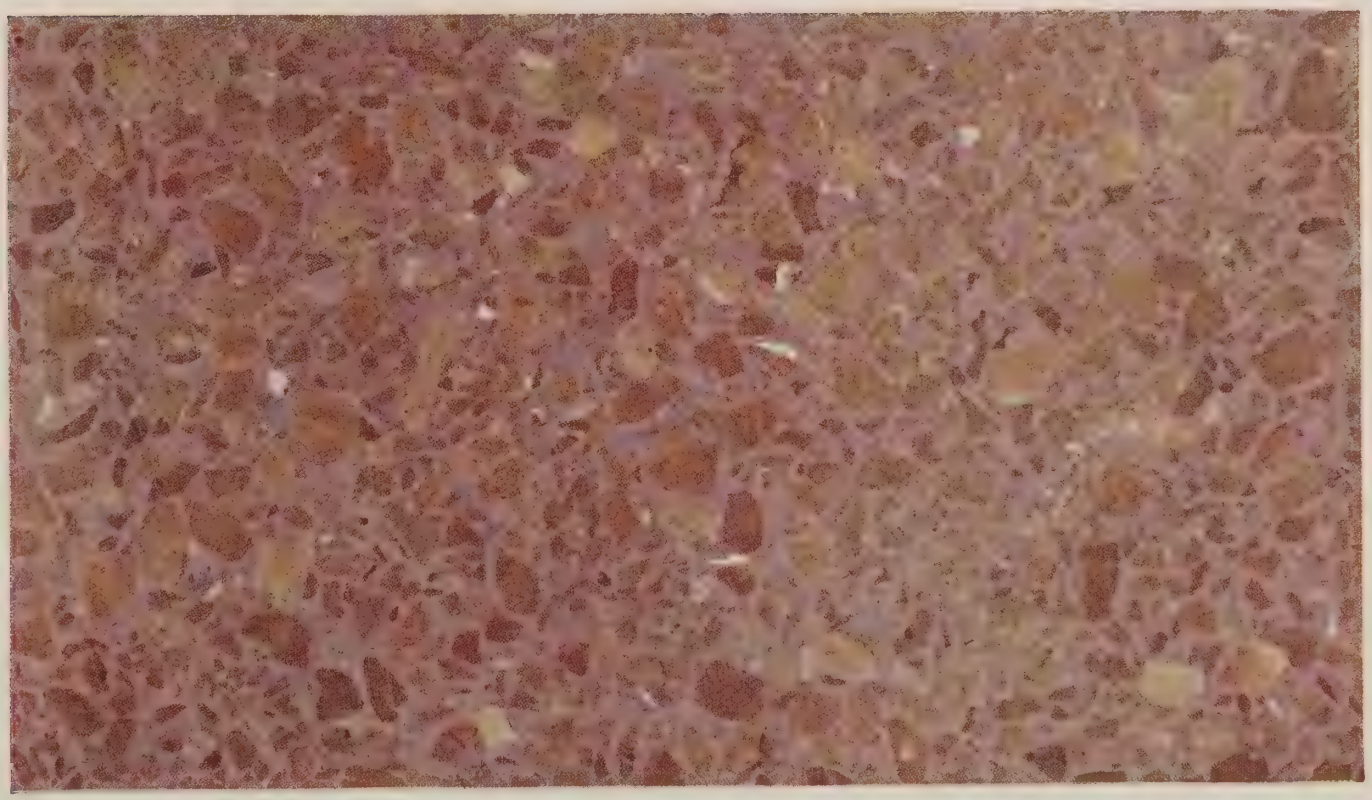


Plate 220



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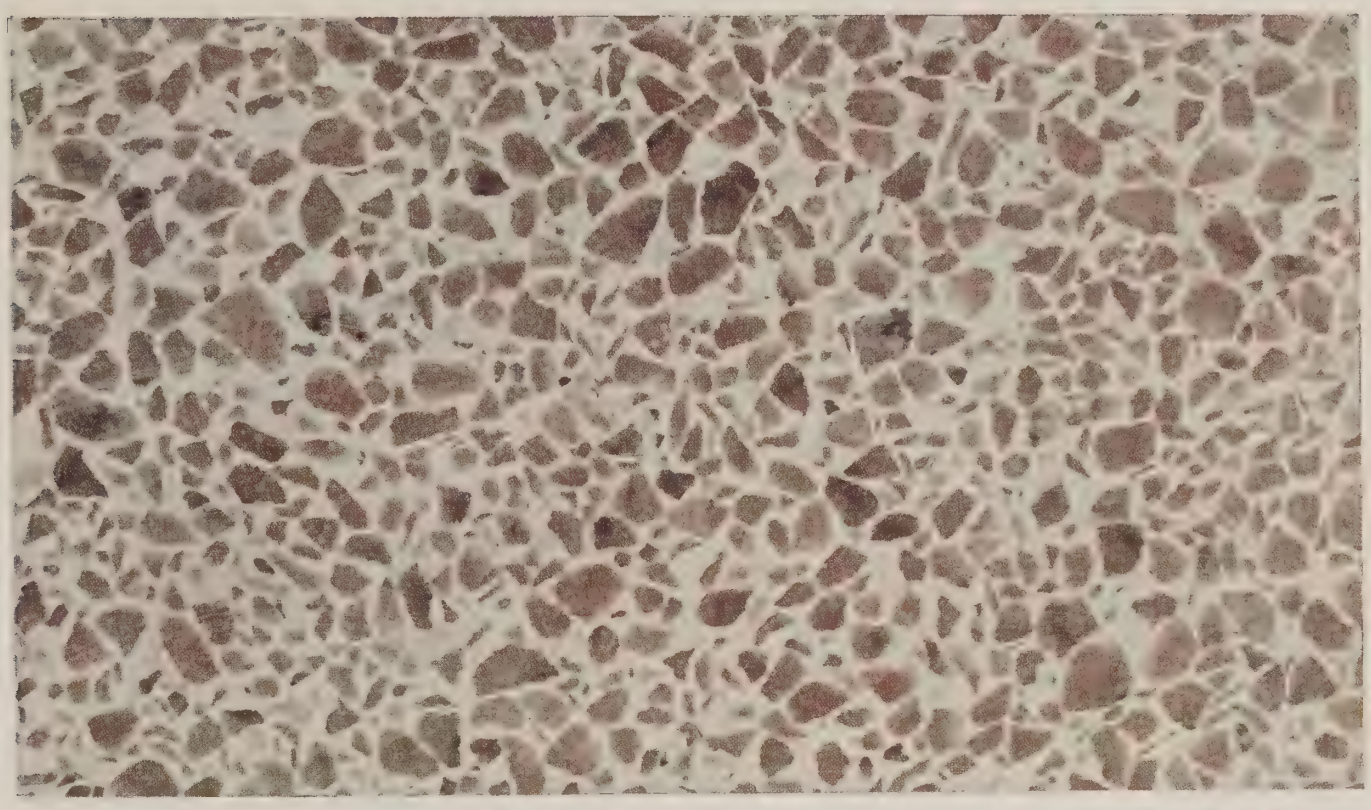

Plate 222

Plate 223

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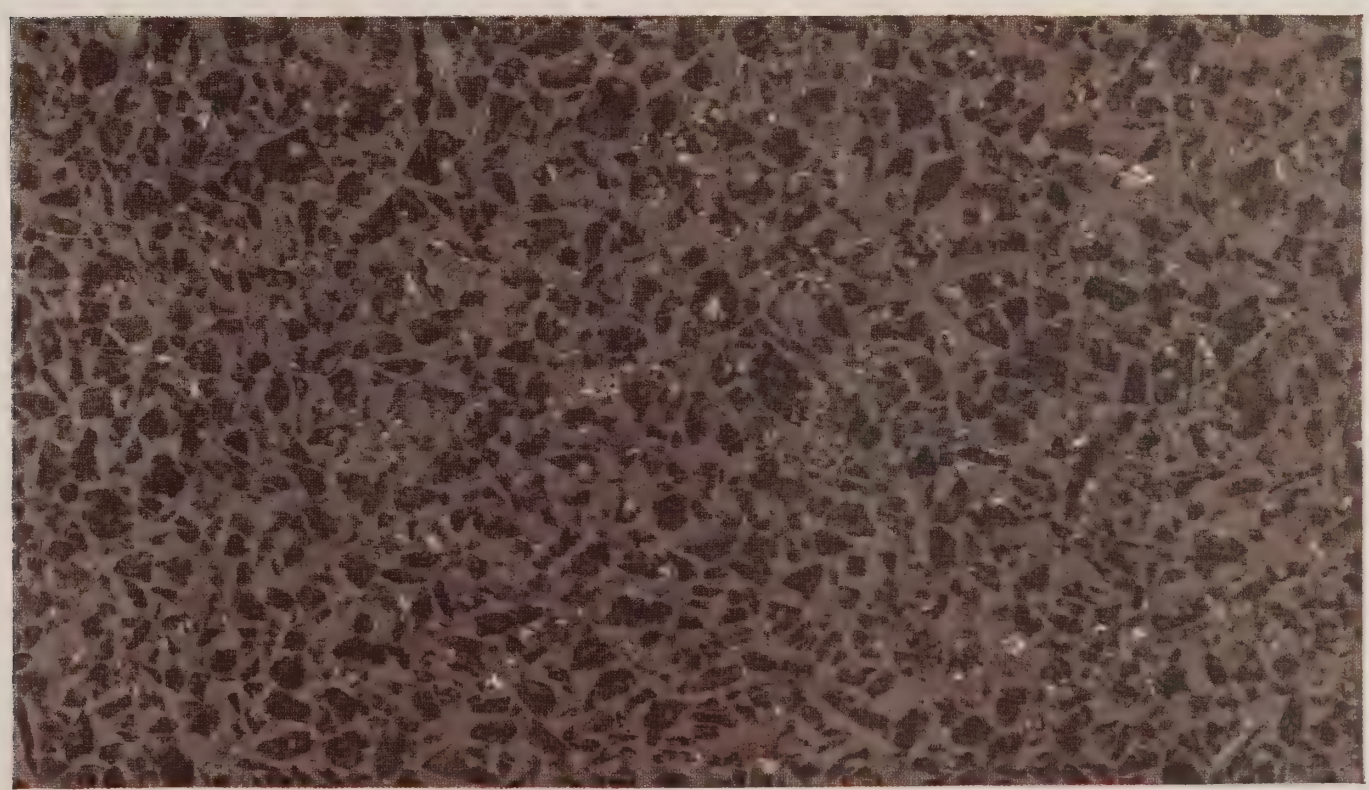
Plate 224



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Five reasons

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white cement

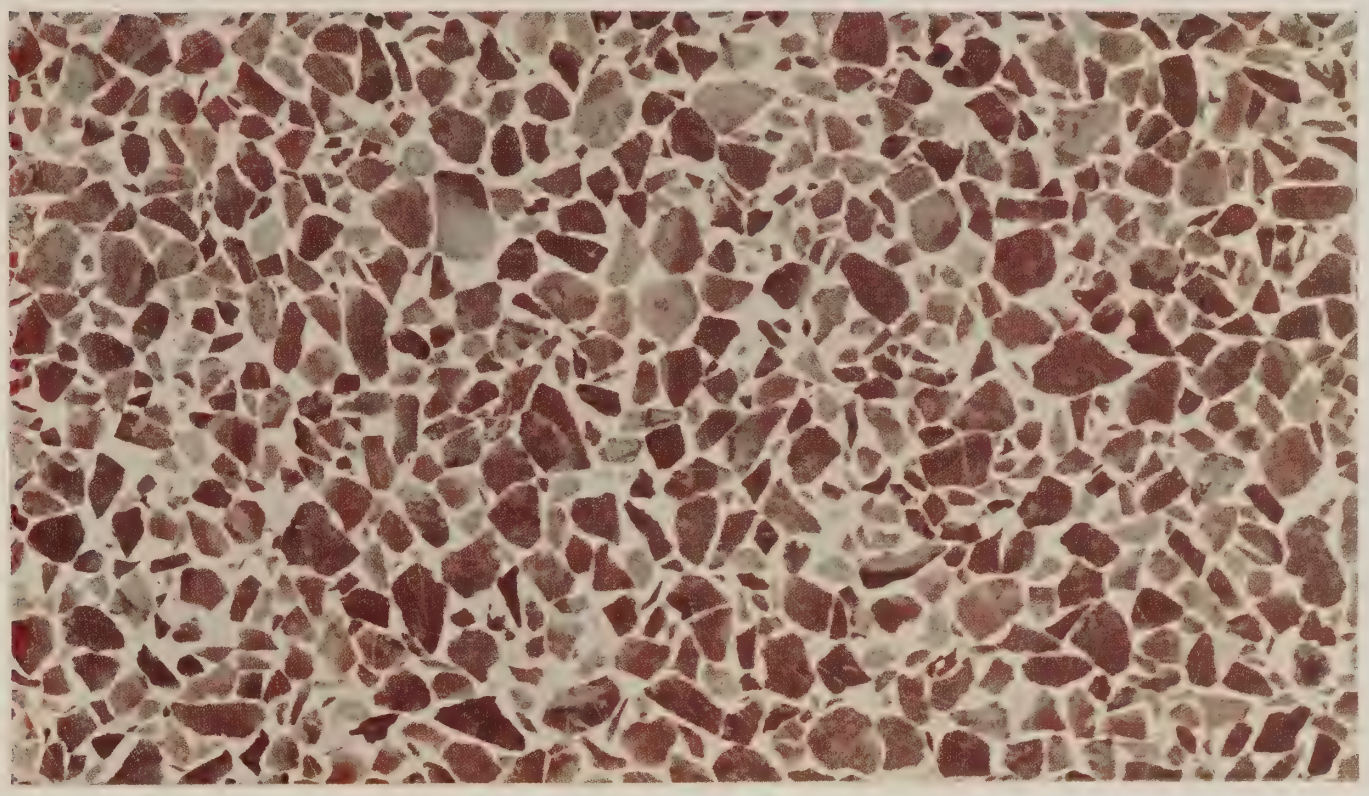
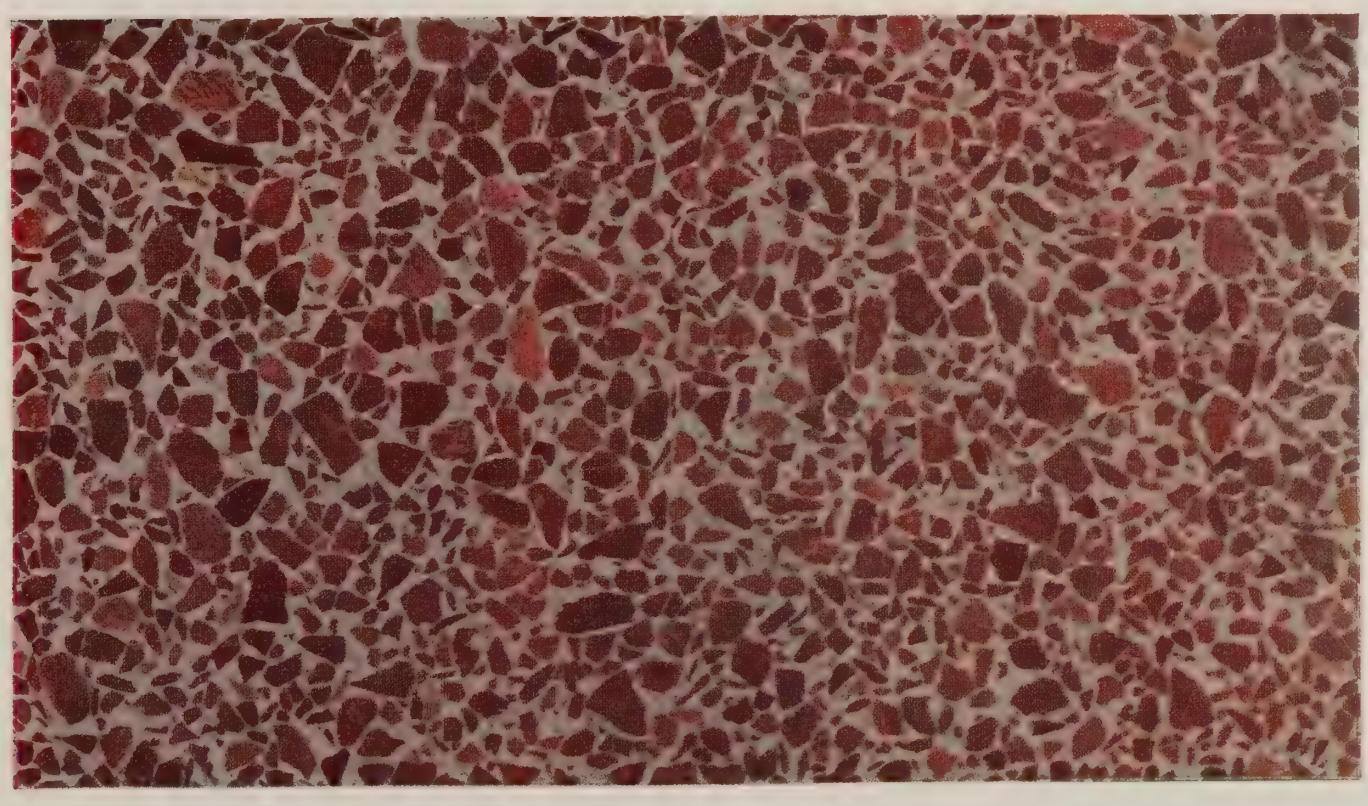


Plate 226



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Five reasons

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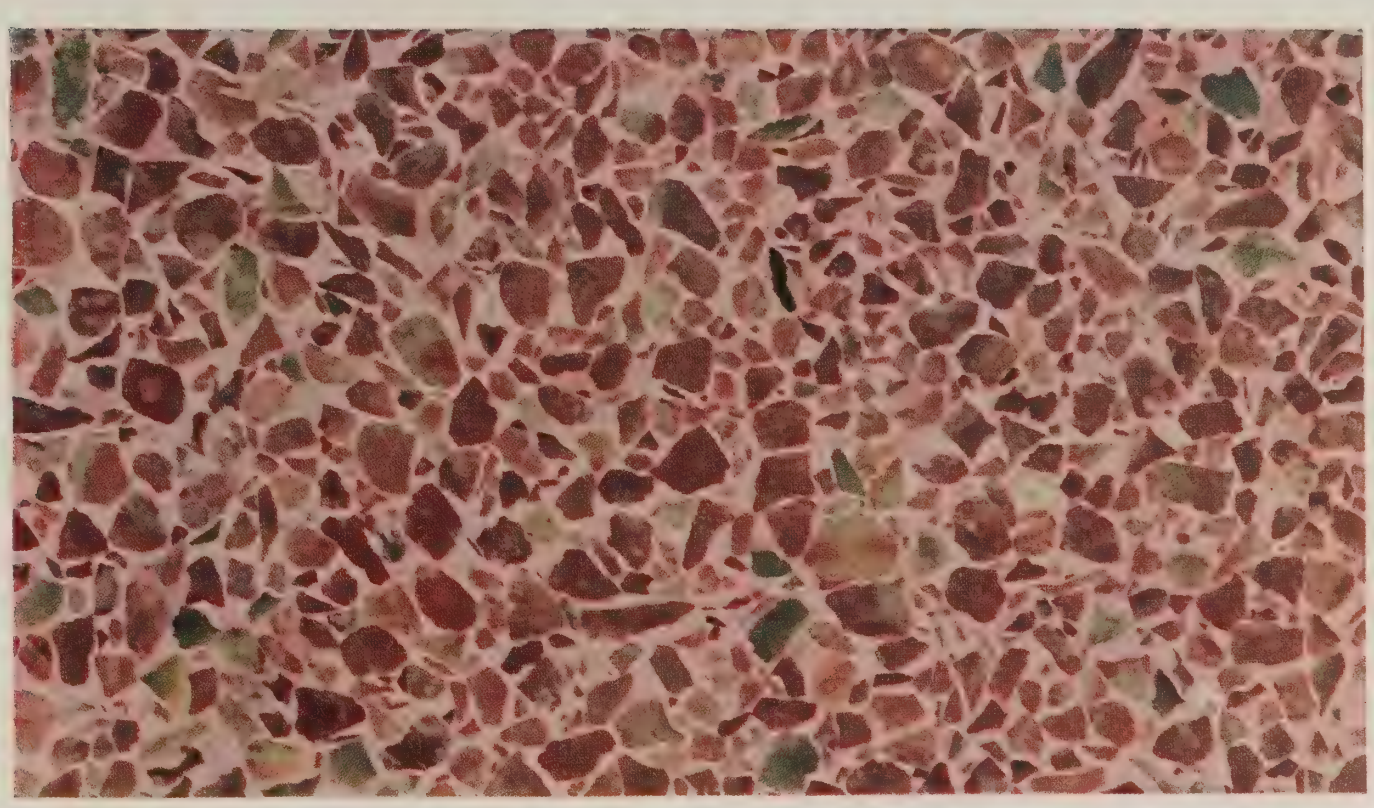

Plate 230

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Five reasons

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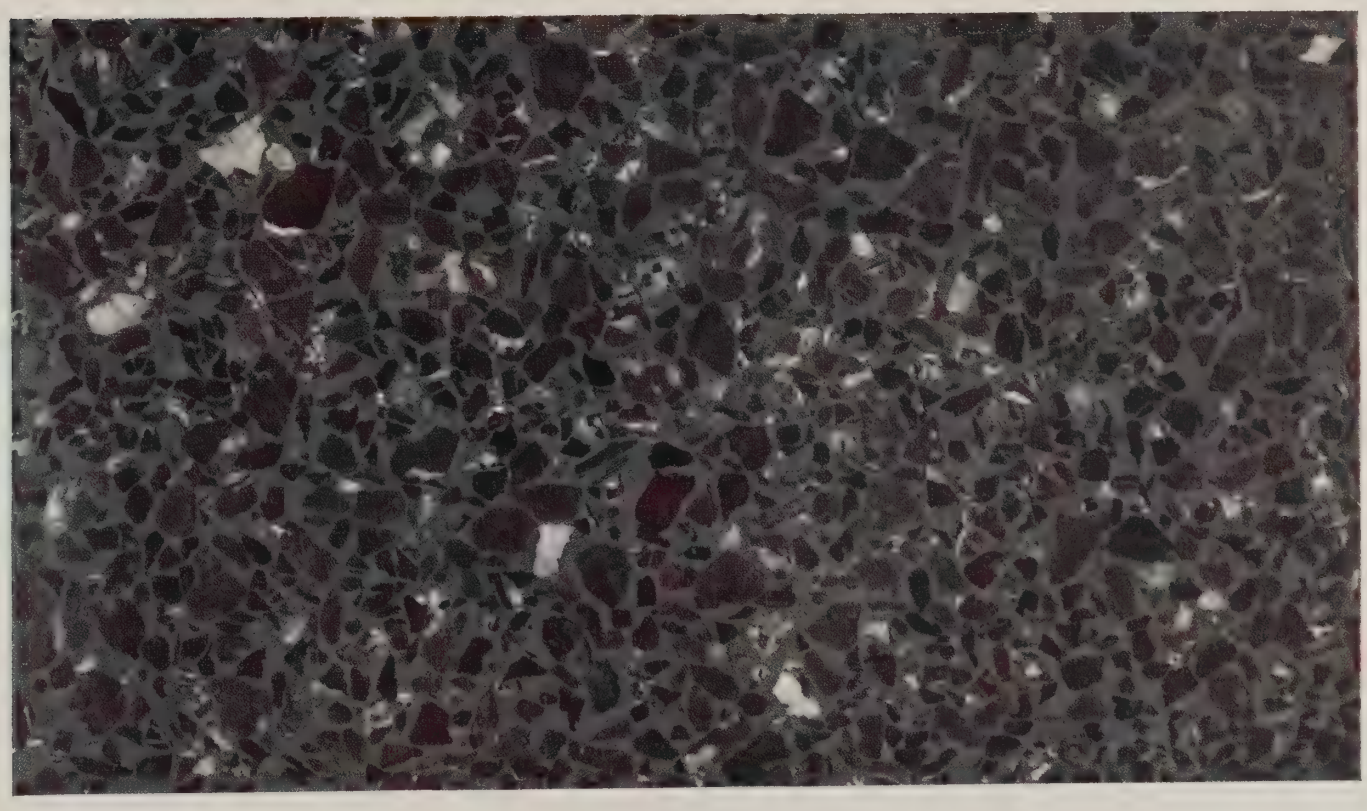
white cement

Plate 232



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Five reasons

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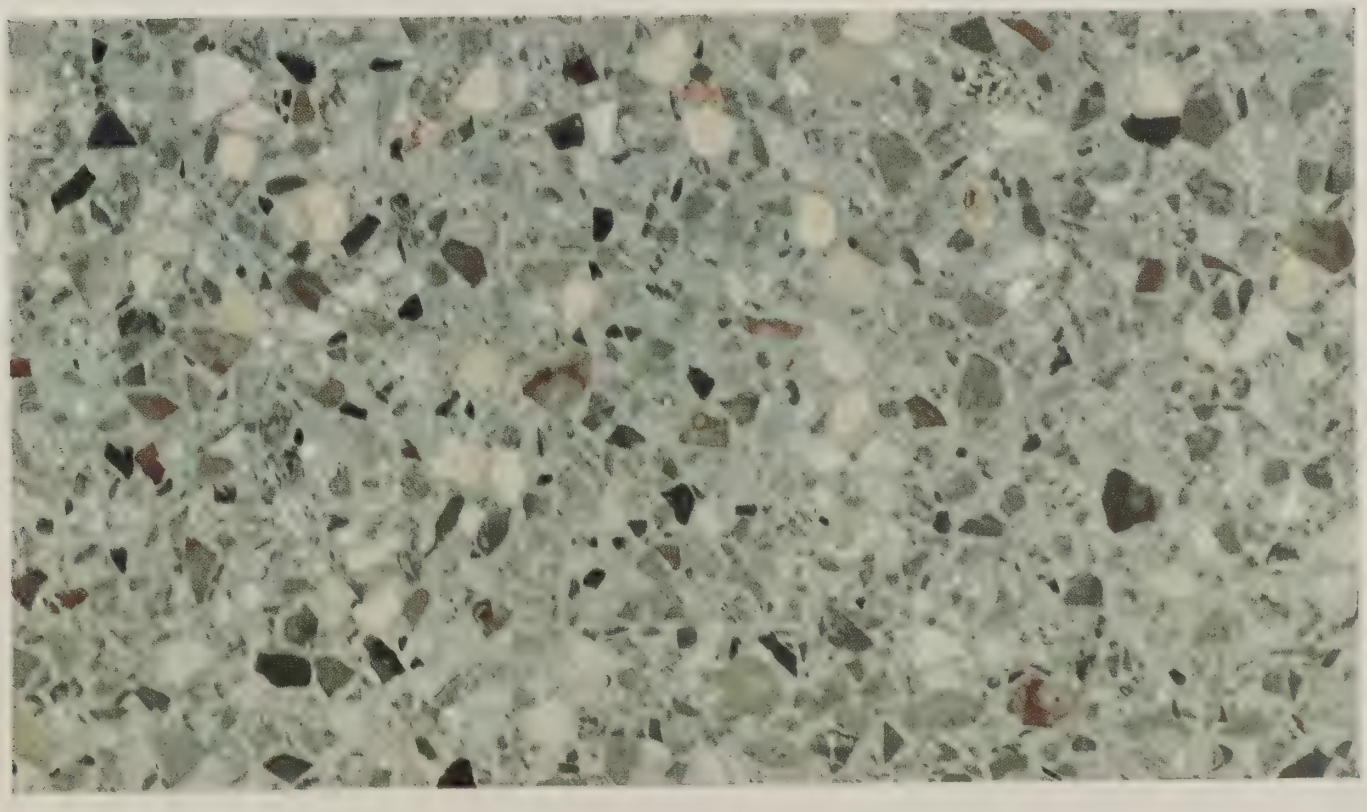
white cement

Plate 234



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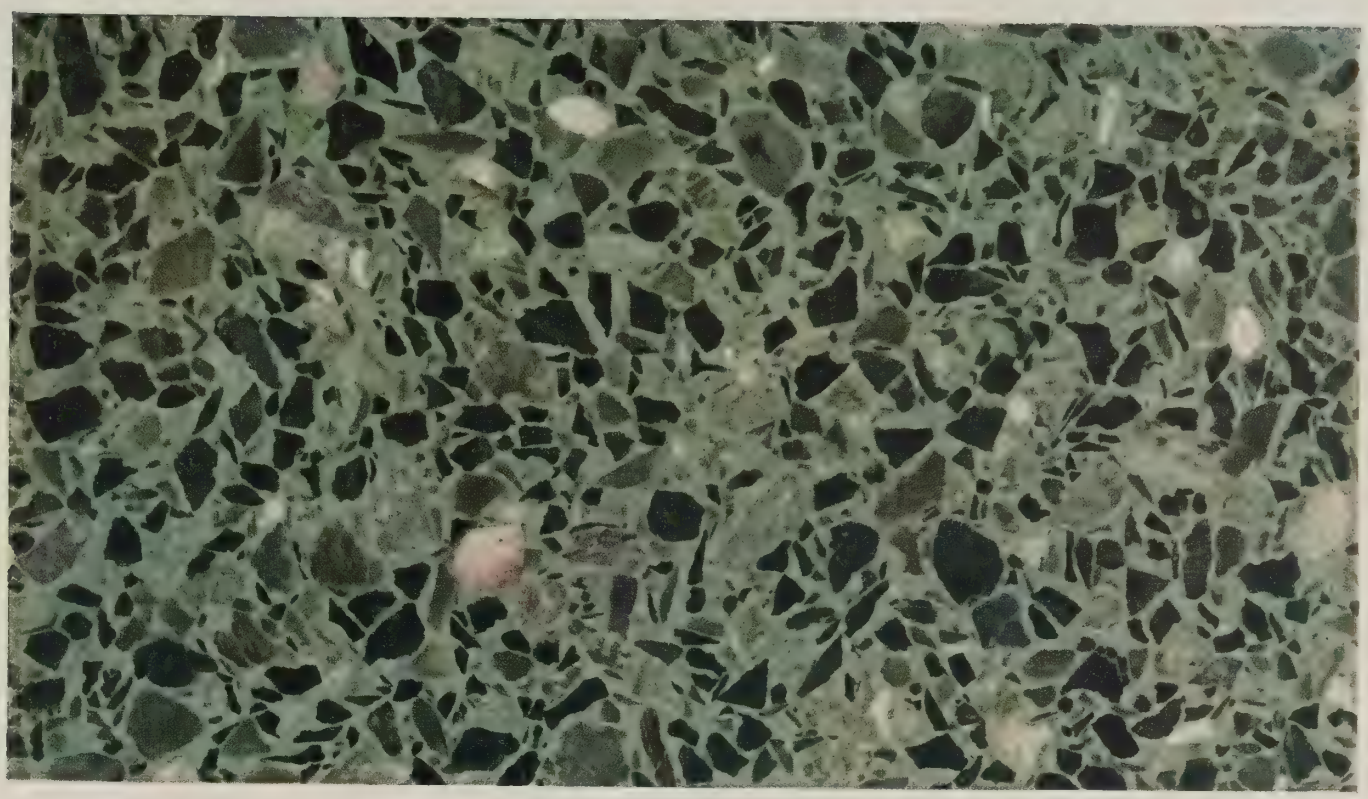
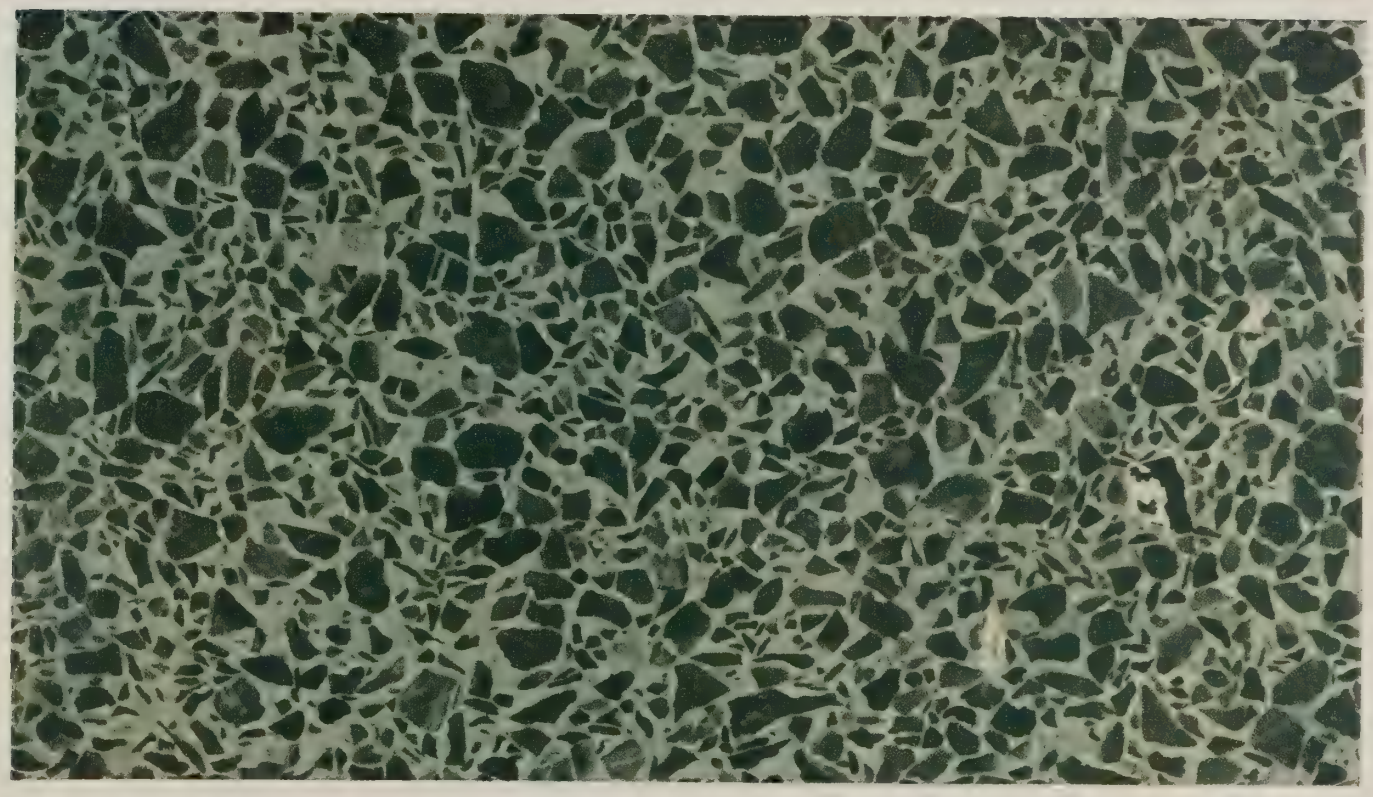


Plate 236



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Five reasons

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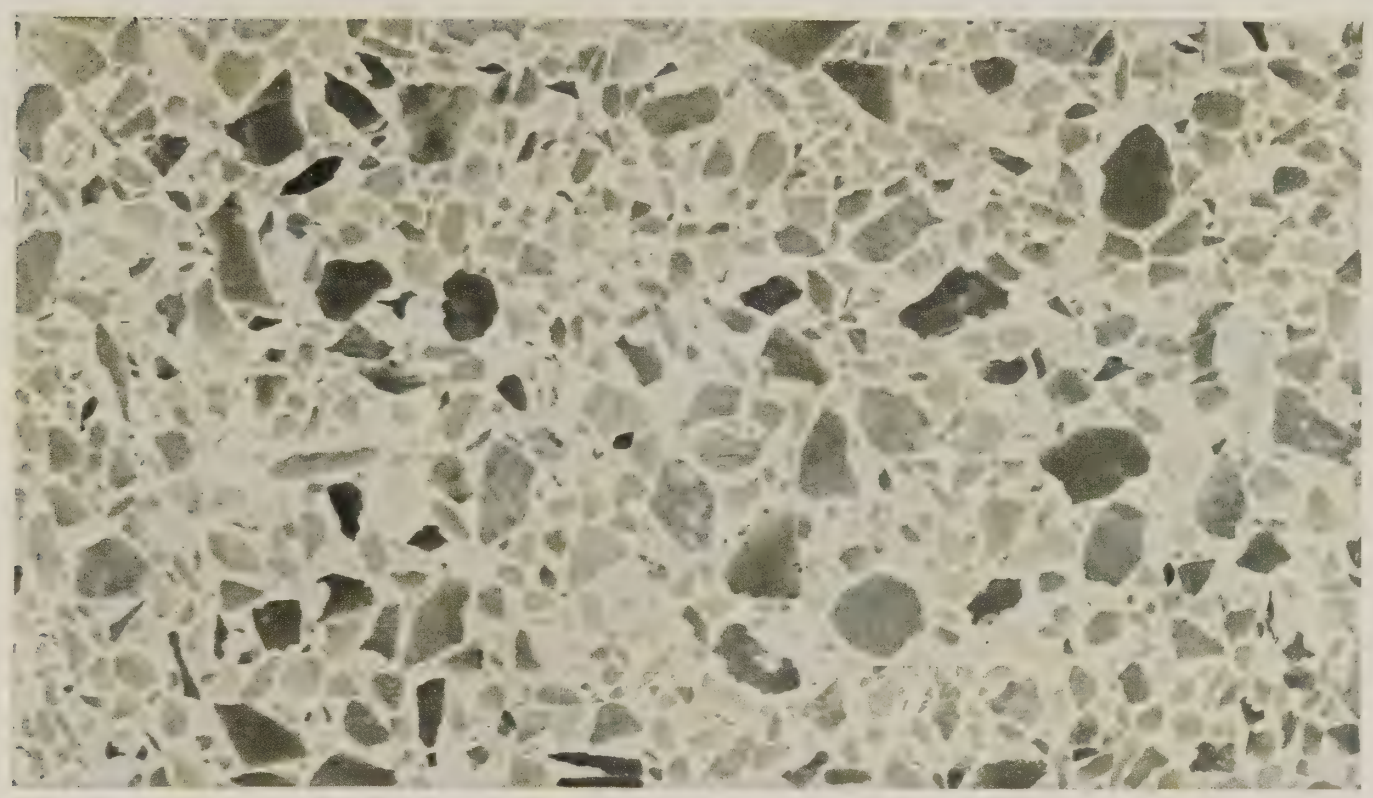
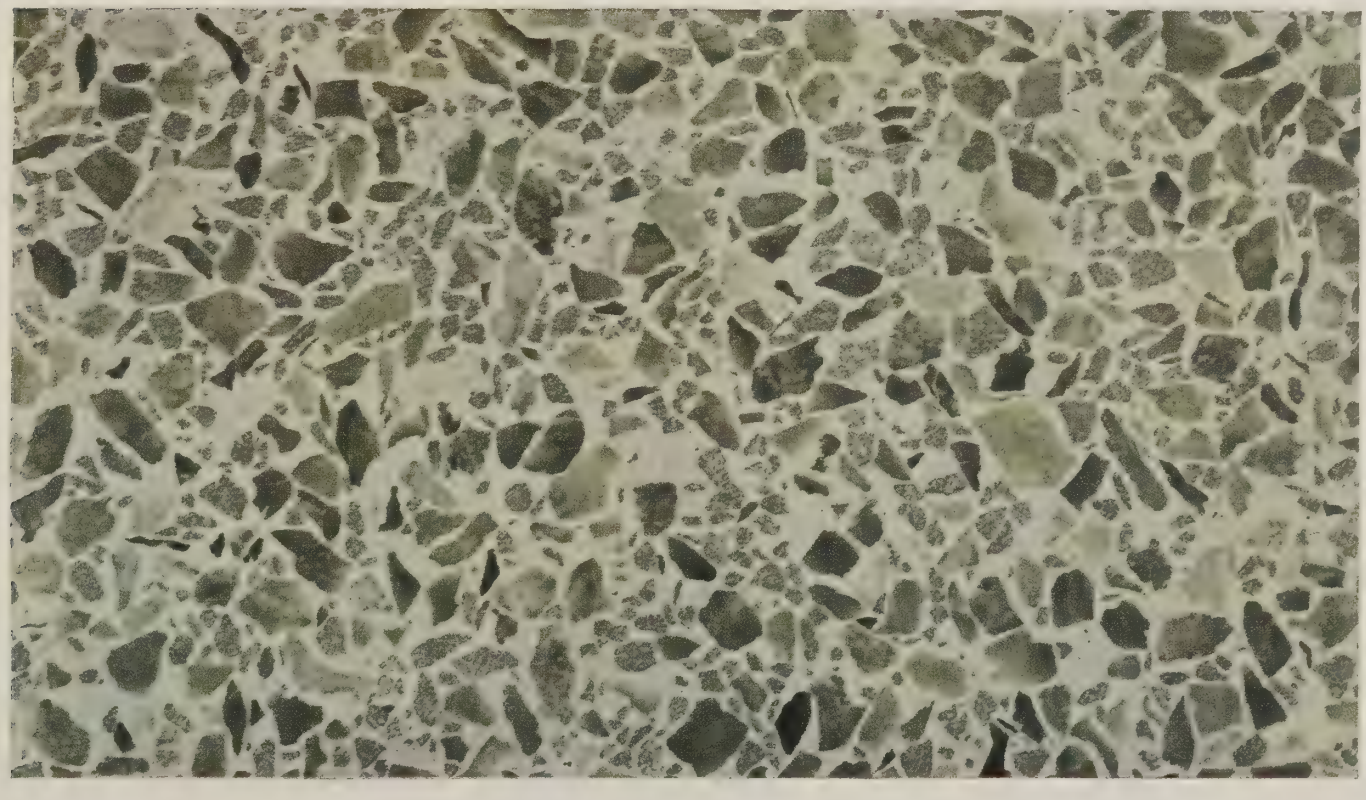


Plate 238



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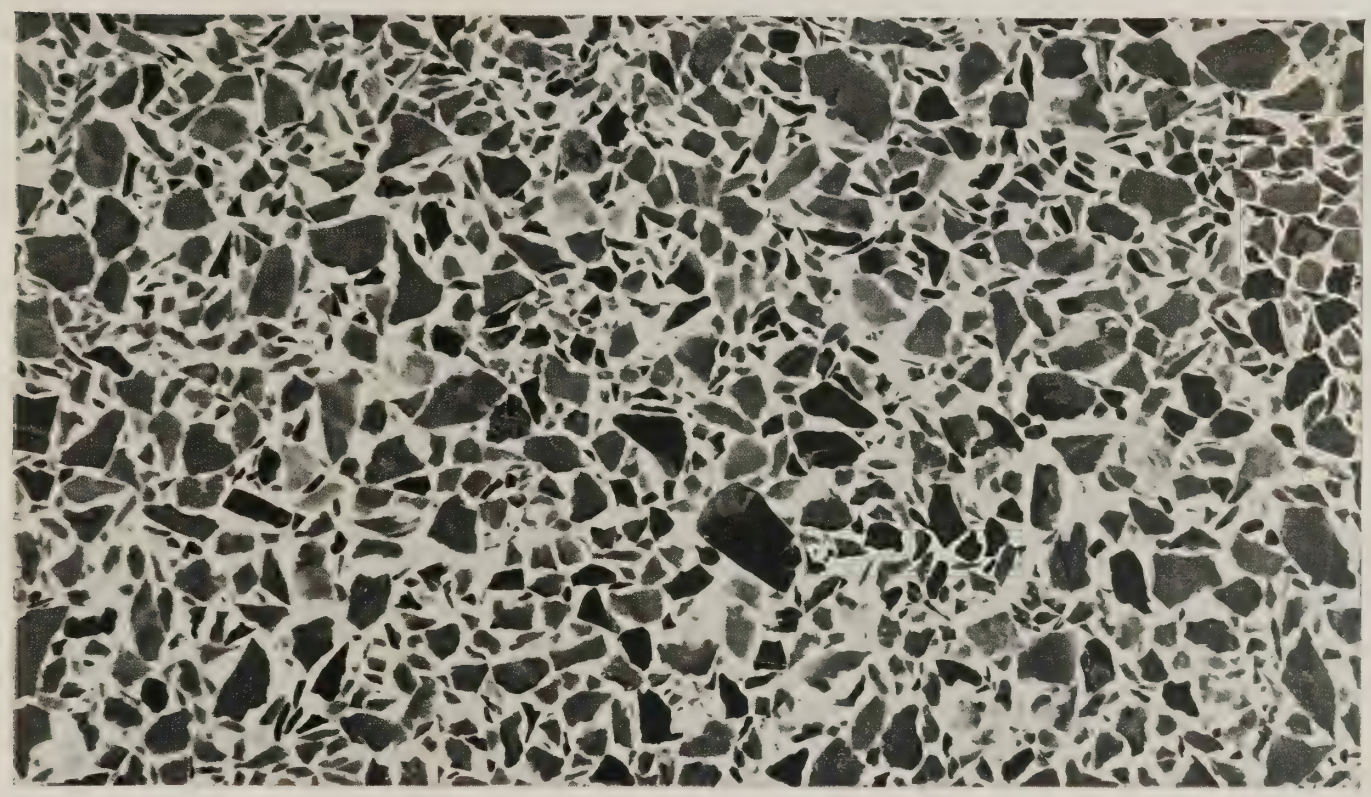

Plate 240

Plate 241

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Five reasons

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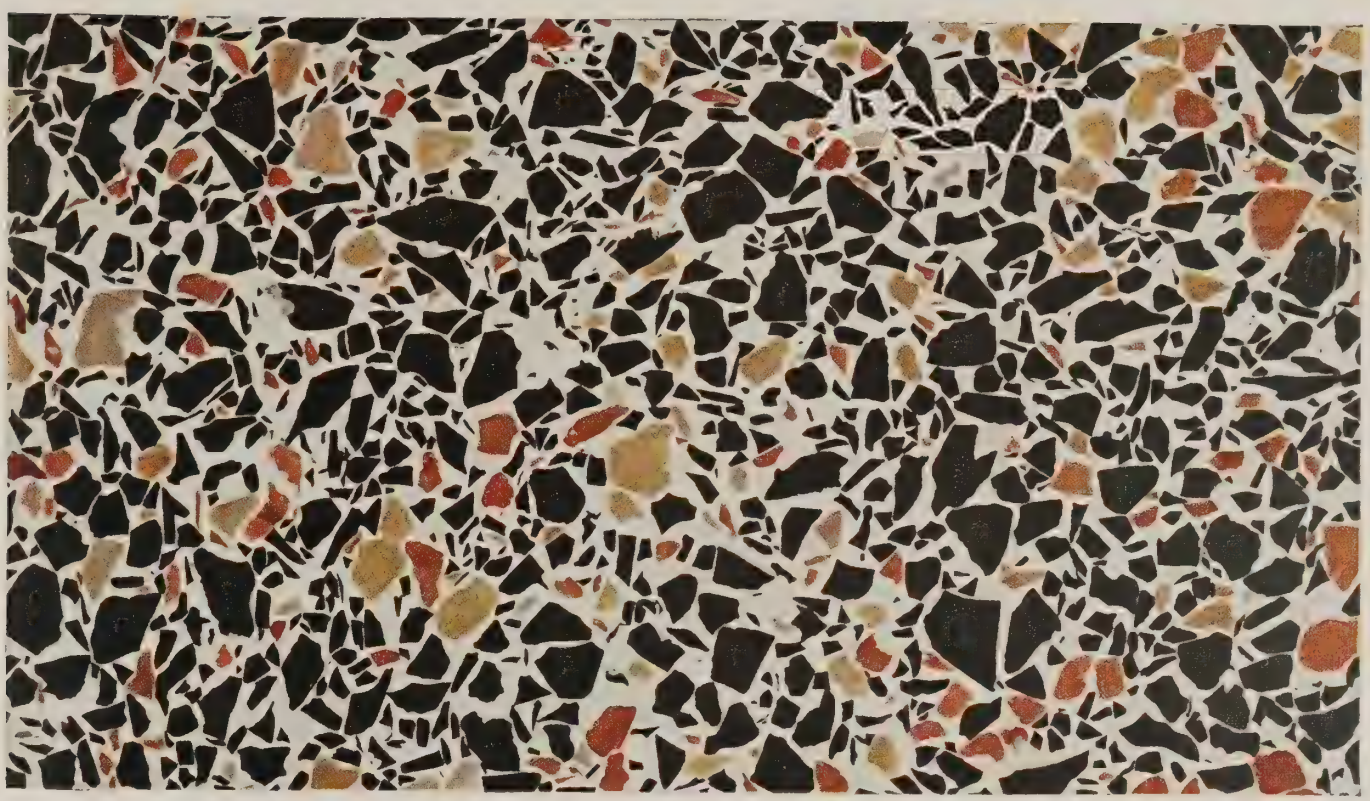

Plate 242

Plate 243

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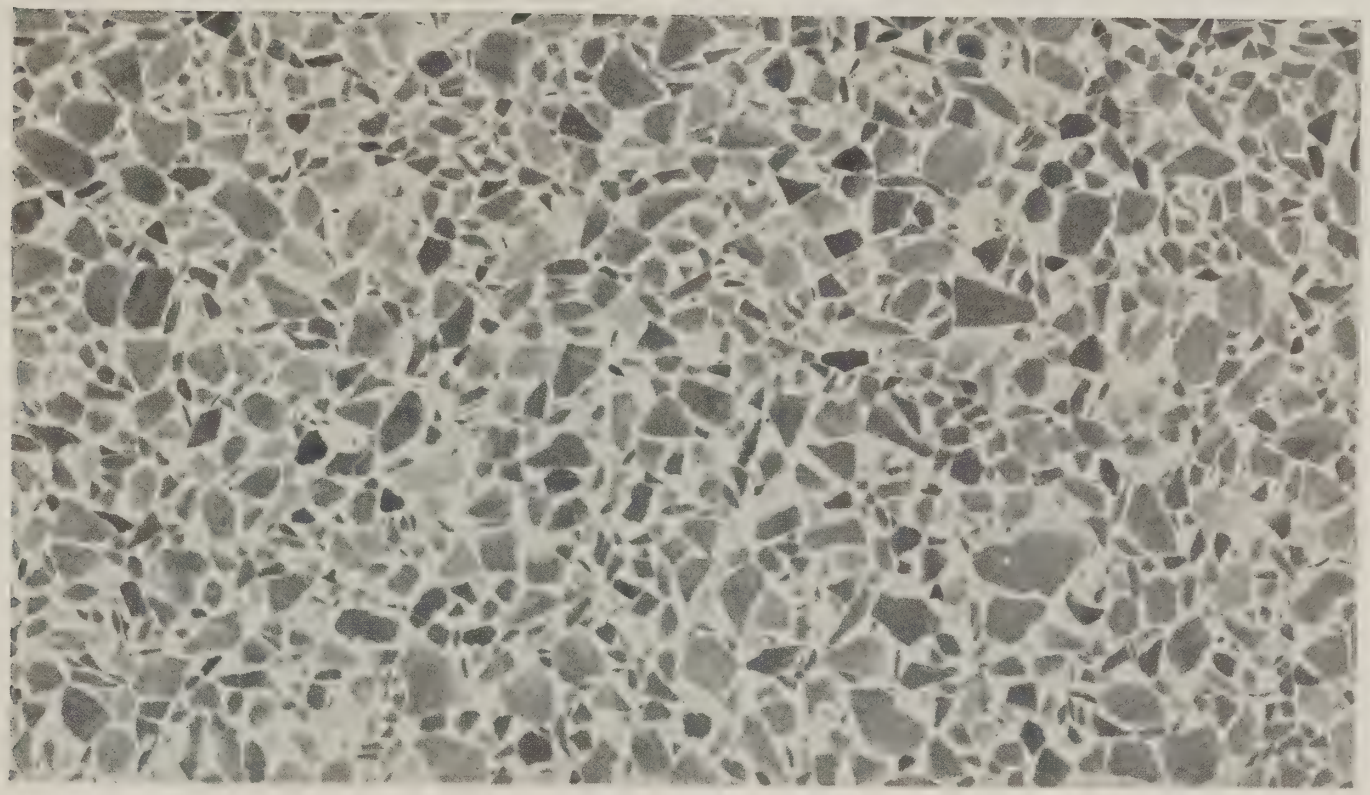

Plate 244

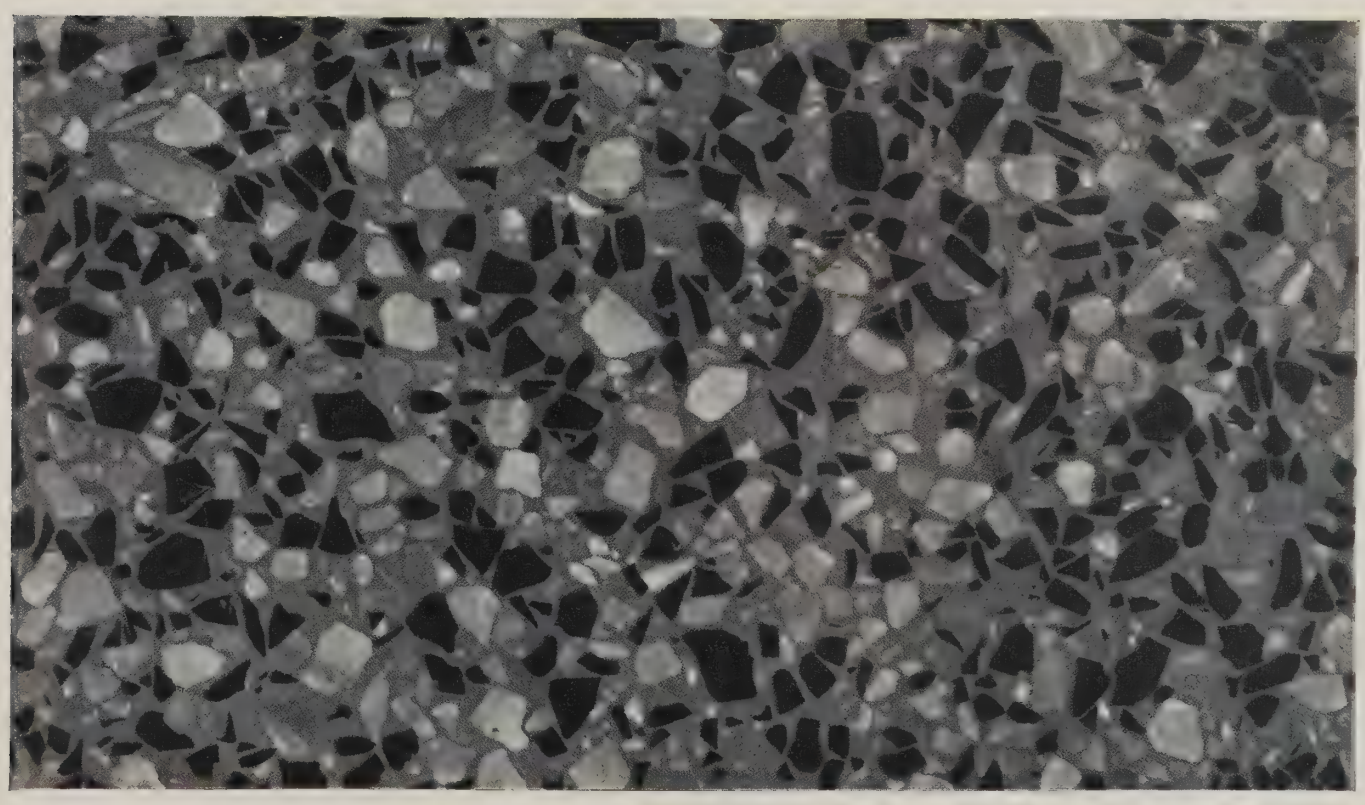

Plate 245

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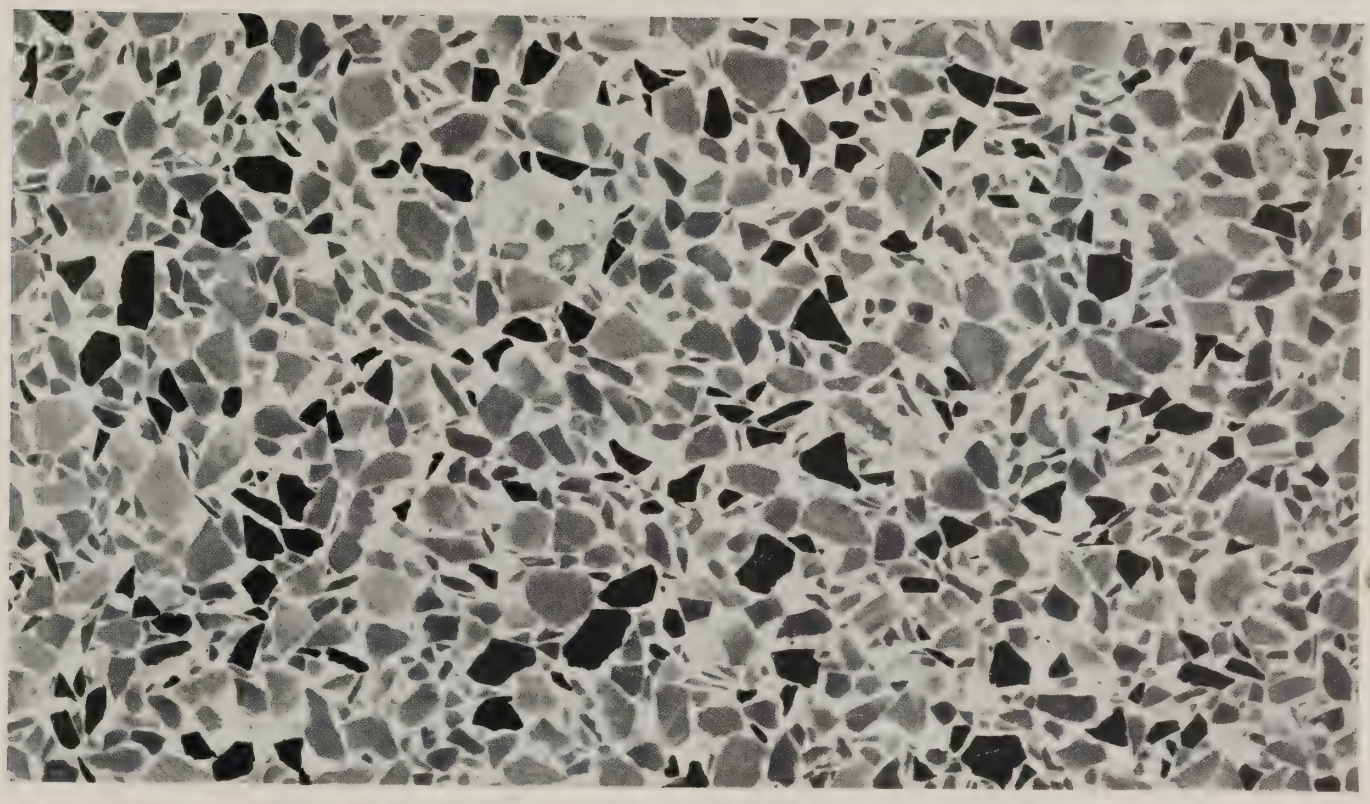

Plate 246

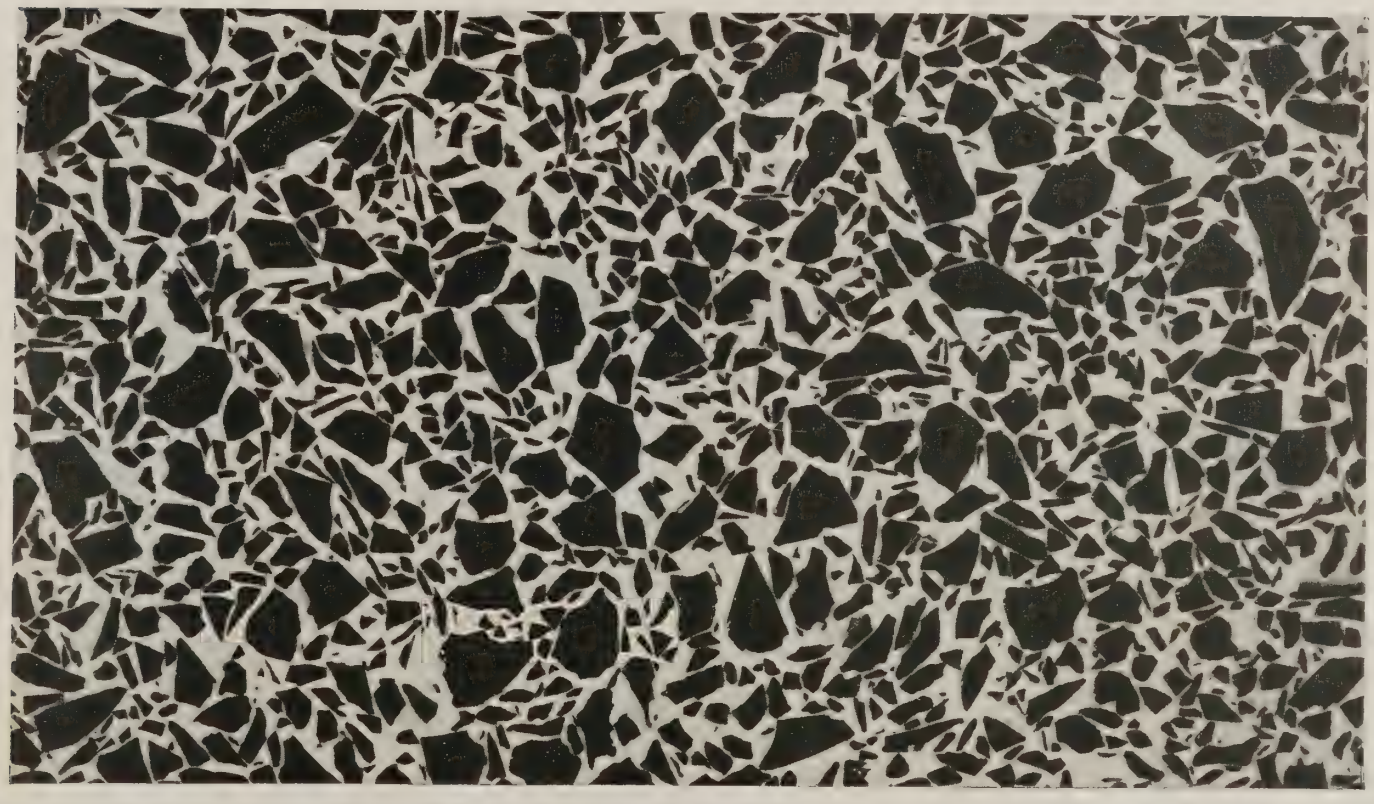

Plate 247

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white cement

Plate 248

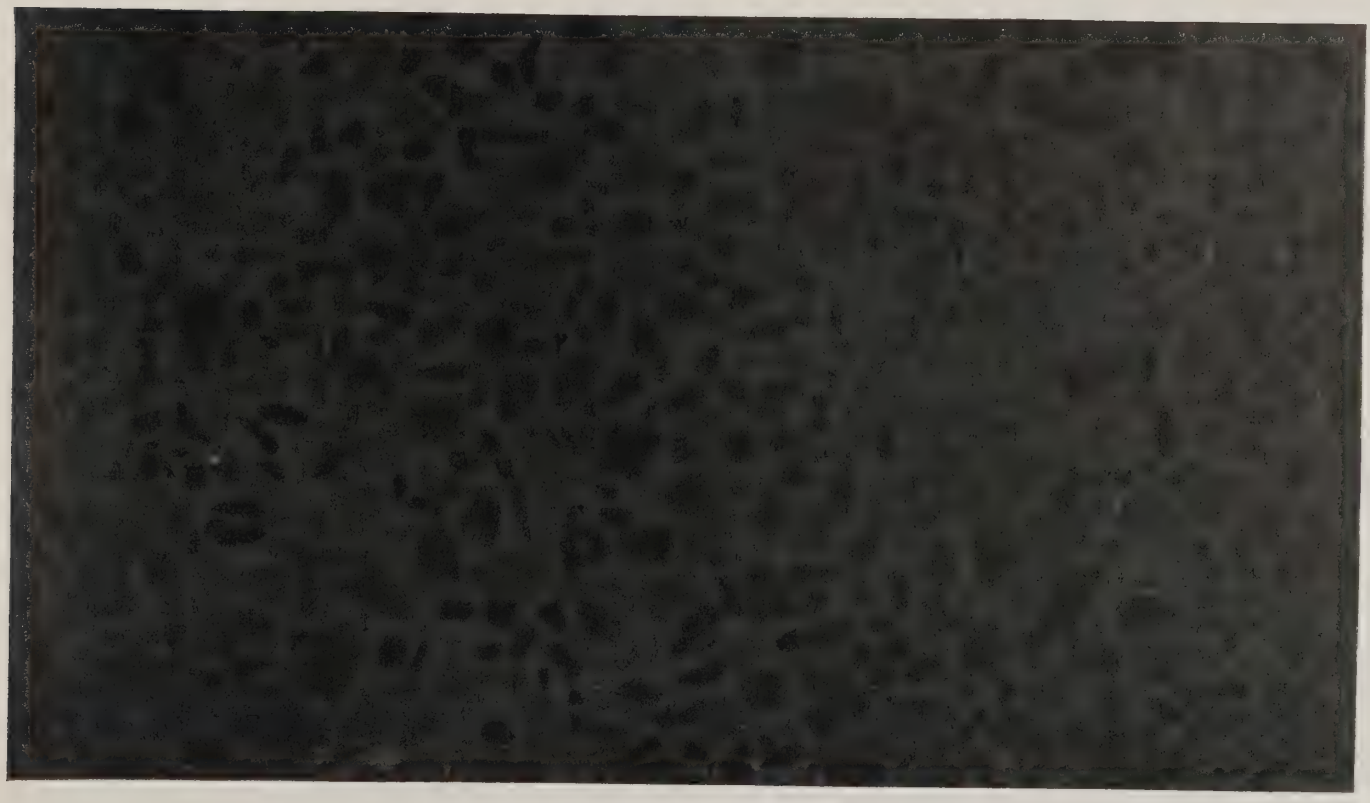

Plate 249

Copyright 1951

white cement

Five reasons

why you will want terrazzo

1. **Economy**—For Terrazzo, initial cost *without* replacements *plus* minimum upkeep costs over a period of years, usually is less than initial cost *plus* replacements and higher upkeep costs for other types of floors.

2. **Comfort**—Finished Terrazzo is *easy to walk on.* It is inherently non-slip in nature and provides a safe walkway surface.

3. **Cleanliness**—Terrazzo has a smooth, jointless surface which *cleans easily,* and thus is sanitary and aseptic. It can be sealed so as to be practically non-absorbent.

4. **Color and Design**—Terrazzo has warmth and beauty. You may specify *any design* you wish—pictorial or geometric—in virtually *any combination of colors.*

5. **Dependable Installation**—This Association's objective is to see that your Terrazzo installations turn out *exactly as you want them.*

THE SYMBOL OF QUALITY
THE NATIONAL TERRAZZO & MOSAIC ASSN., INC.
INCORPORATED 1931
NEW JERSEY
FOR FINE TERRAZZO PATRONIZE OUR MEMBERS

venetian

terrazzo plates

Also known as Pavimento alla Veneziana or Terrazzo Veneziano as it is called in Italy. Originating with the Venetians, these ingenuous people spread a layer of lime mortar, into which fragments of marble were imbedded. First the larger pieces were set, then the medium size pieces, with smaller ones sprinkled in between the larger pieces to fill in the voids, making a homogeneous mass. Then the whole was tamped and rolled into the mortar. This material was allowed to set and become hard, after which it was ground and finished with abrasive material quite like the present Terrazzo is treated.

Venetian Terrazzo originating in the early days of the Roman era, was probably the forerunner of Terrazzo, as it is known today. We may safely say Venetian Terrazzo was the original Terrazzo Mosaic.

Venetian Terrazzo is more expensive than the standard type made of smaller aggregates, since it requires more skill, demanding hand placing of the larger pieces. It is a more interesting floor having greater artistic value inasmuch as greater contrasts of color can be obtained by the use of larger aggregates.

Berliner Mosaic is still another form of Terrazzo probably a development of Venetian Terrazzo. In this type of Terrazzo, larger fragments, many times the size of that employed in making the Venetian Terrazzo, is laid by hand and the spaces in between these larger fragments are filled with small aggregate sprinkled in between them.

A Venetian Terrazzo floor, in pattern, in a living room.

venetian terrazzo

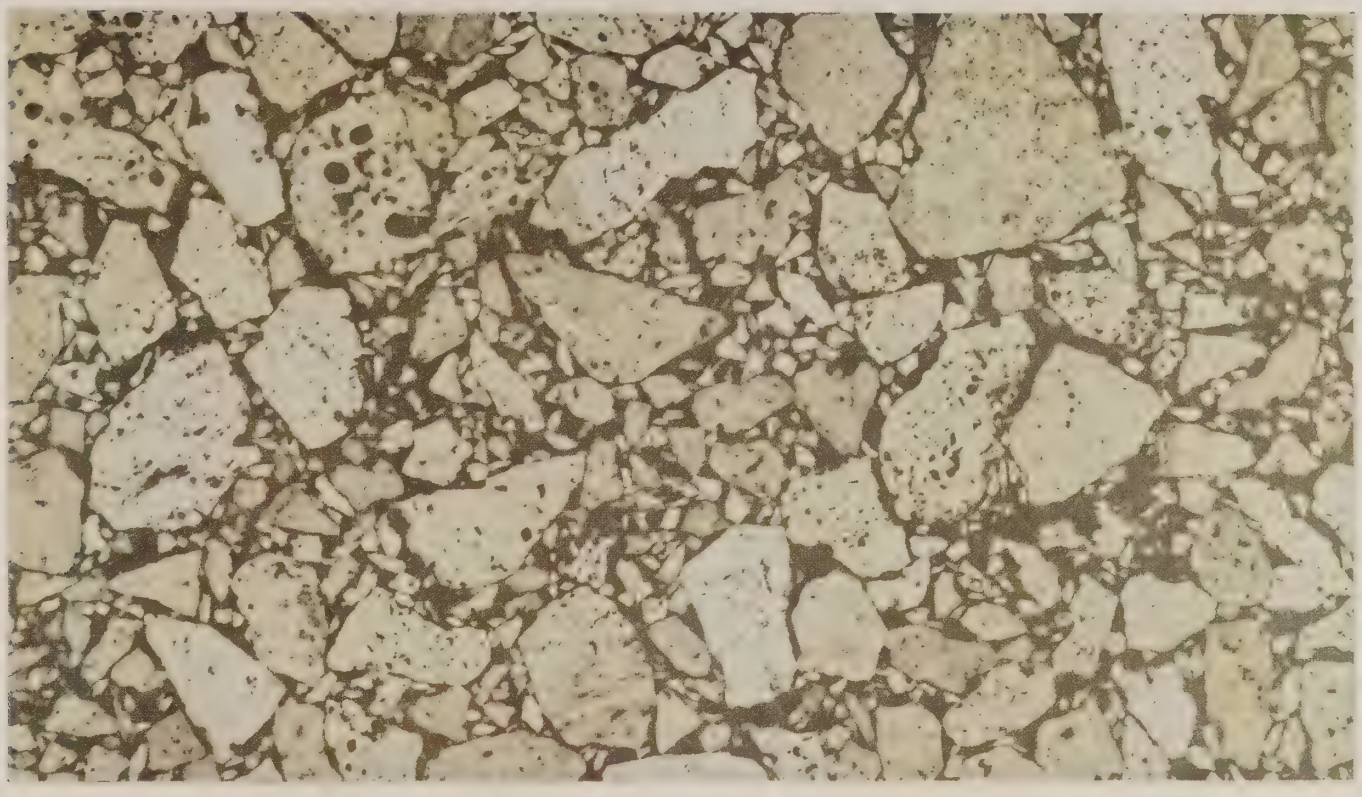

Plate 300

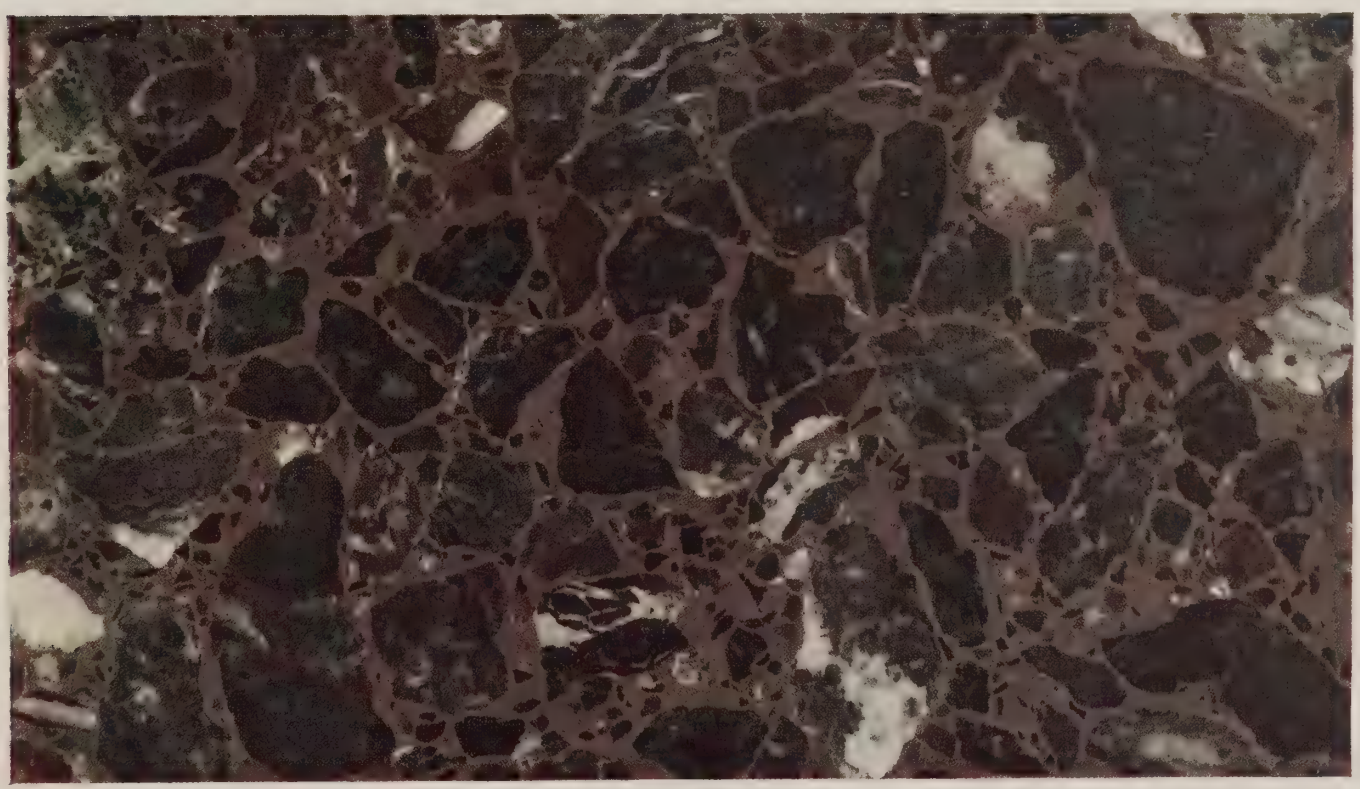

Plate 301

Copyright 1951

venetian terrazzo

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venetian terrazzo

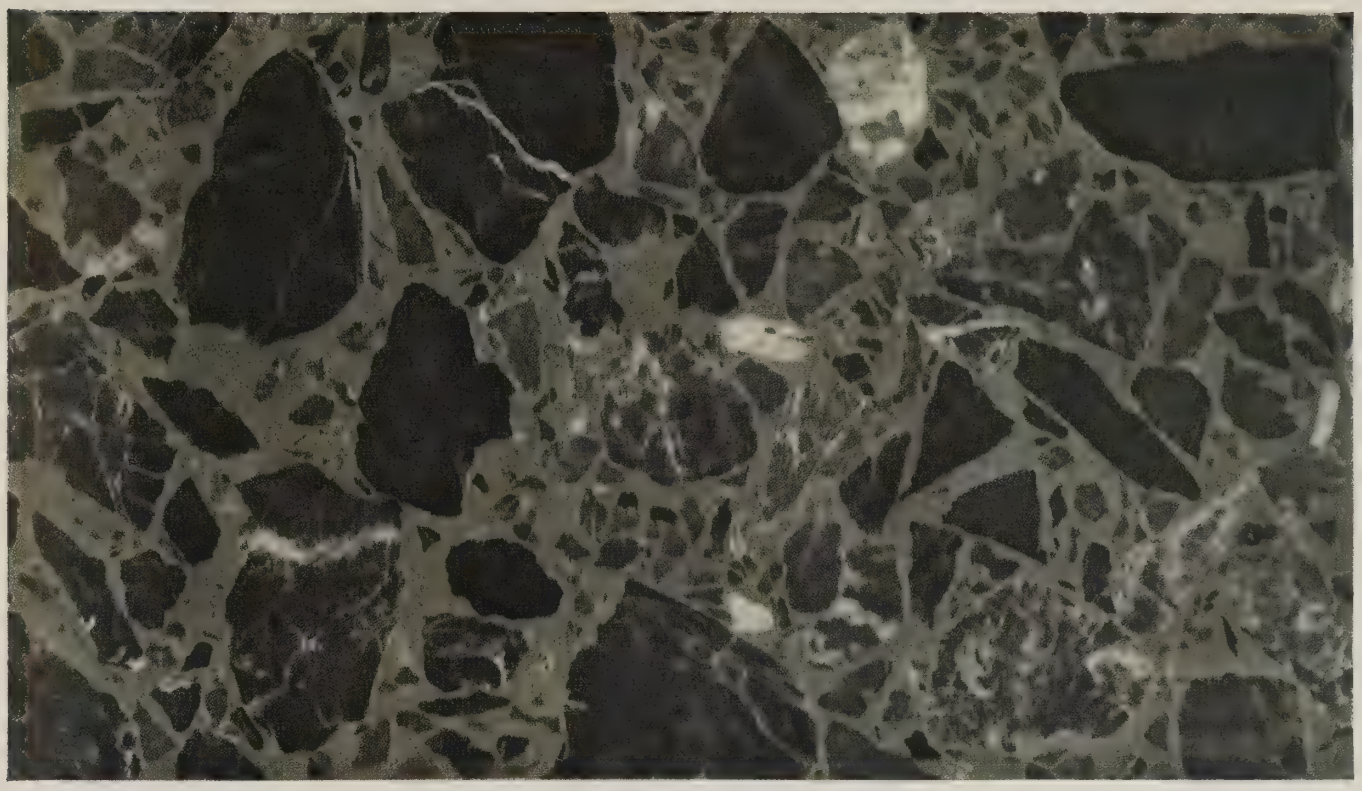

Plate 302

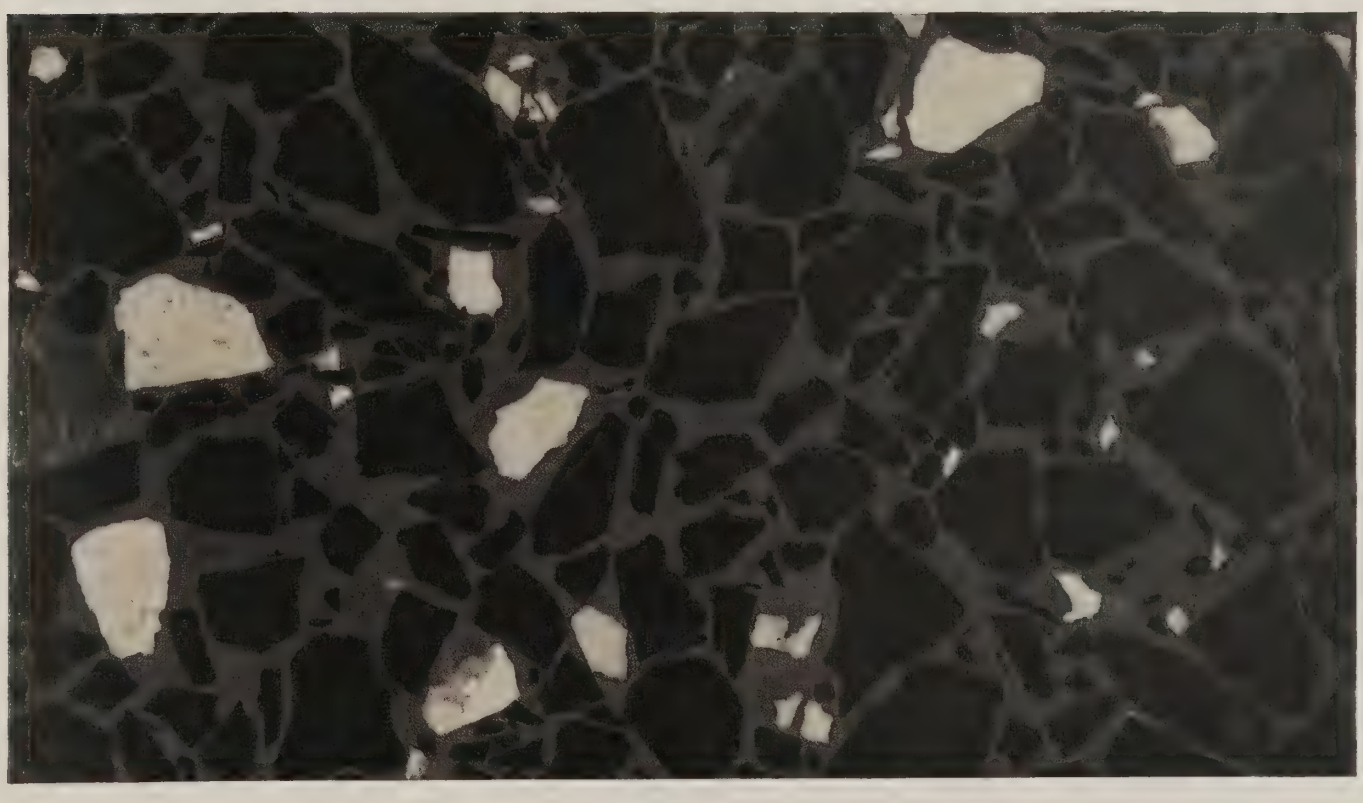

Plate 303

Copyright 1951

venetian terrazzo

Five reasons

why you will want terrazzo

1. **Economy**—For Terrazzo, initial cost ***without*** replacements ***plus*** minimum upkeep costs over a period of years, usually is less than initial cost ***plus*** replacements and higher upkeep costs for other types of floors.

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THE SYMBOL OF QUALITY
THE NATIONAL TERRAZZO & MOSAIC ASSN., INC.
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FOR FINE TERRAZZO PATRONIZE OUR MEMBERS

pictorial

Outdoor Terrazzo

The sky and the sea . . . **and a floor of fine terrazzo**

pictorial

An Apartment Hotel Lobby

...and a floorful of color!

pictorial

A pleasing design showing possibilities of advertising a commercial product

. . . for life-long beauty and utility

pictorial

A Symmetrical Design
for a Recreation Room

Harmony in color
and pattern

pictorial

This Indian rug design demonstrates the flexibility of Terrazzo

...and makes a comfortable Club Lounge

pictorial

A Busy Street

beauty of a terrazzo pavement

Mosaic—an ageless art

Outstanding beauty and interest can be given to today's buildings of all types as well as to churches by means of mosaics that are composed of colorful tesserae of vitreous material set in a cement mastic. These mosaics form an integral part of the wall or ceiling surface and are lasting, whether indoors or on the exterior.

Brilliant or subtle colorings can be chosen as the hues and tints available in this material are unlimited. These mosaics can be made marvelously rich with gold and silver tesserae that retain their brilliancy.

This art of mosaic in vitreous material knows no limitations of style. Since the dawn of civilization it has kept pace with the changes in the manner of design. Because it reached a high stage of development in ancient Constantinople, it is frequently called "Byzantine" mosaic and because it flourished in old Venice it is generally known as "Venetian" mosaic, to distinguish it from the types of mosaic that are formed of tesserae of marble, instead of vitreous material. However, it lends itself to modern design as readily as to the traditional forms with which it has been associated. Because it is basically simple, consisting of the arrangement of small pieces of vitreous material in whatever way the designer may choose, this art is ageless.

TO-DAY'S TECHNIQUE

The creation of a modern design technique for this type of mosaic has been aided very greatly by the knowledge of the old Byzantine and Venetian techniques, contributed, along with their skill, by experienced mosaic craftsmen collaborating with architects and designers. The better craftsmen, as a rule, are eager to take part in this new development of their art.

This type of mosaic (Venetian or Byzantine) is called "enamel mosaic" because it is formed of pieces (tesserae) of "enamel," a vitreous material of the nature of glass, but different from glass in that it contains much pigment, which provides its coloring and makes it opaque. The gold tesserae used with the enamel tesserae consist of glass upon which gold leaf has been placed and covered with a film of glass, fused on to protect the gold.

Today the members of this association, through well organized operation, including planning and the coordination of the skill of its craftsmen are able to produce in a short time mosaics that are well studied and well executed in every respect.

mosaic, an ageless art

Famous mosaics of the old world

The Battle of Issus, in the house of the Faun, Pompeii, Italy.

The Battle of Arbela, in the ruins of Pompeii (excavated), Italy.

The Nereids and Centaurs in the Sala Rotunda at the Vatican, Rome, Italy.

The Triumph of Neptune and Amphitrite at Condiat.

The Doves of Pliny, now on exhibition at Capital Museum, London, England.

St. Marks Church in Venice, Italy, Murals of Scriptural subjects.

The murals of St. Sophia Church in Istanbul, Turkey.

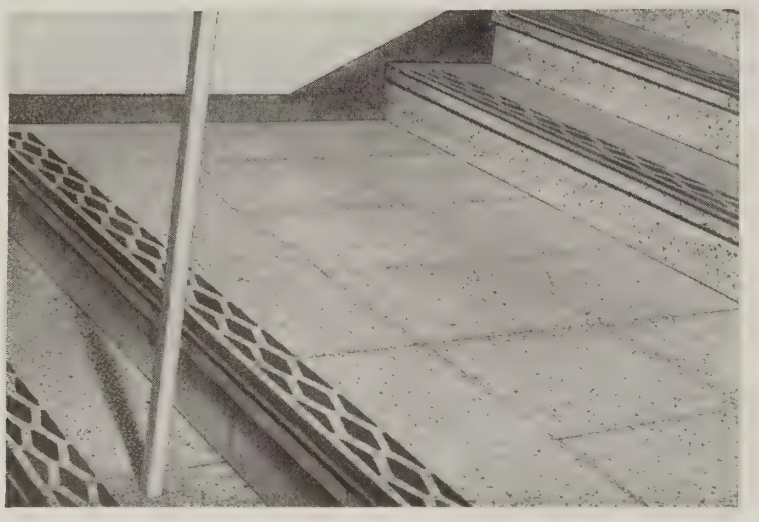
MADONNA AND CHILD
One of the most famous of Biblical subjects painted by the great Masters and perpetuated in Mosaic Murals in many of the Ancient Churches of Europe.

Precast terrazzo (Art. Marble)

Precast Terrazzo or Artificial Marble (Art. Marble) is a form of Terrazzo which is cast in the various shapes for which it is intended, in molds or forms.

Shop-made Terrazzo work such as floor tiles, Sanitary Cove base, stair treads and risers, partitions, wainscot slabs, columns, etc. are made much in the same manner as monolithic Terrazzo. The marble aggregate is mixed with Portland Cement and poured into molds and pressed under great pressure. It is rubbed on a rubbing bed and follows the general procedure through the marble mill as a slab of marble. When completed it has received a final polish of oxalic acid and French putty and is set in place on the job by the same tradesmen that handle marble products of a similar type.

Majestic Precast Terrazzo Columns enhance the appearance of this building lobby.



Illustrating the use of precast terrazzo on treads, risers and landings.

A precast terrazzo counter.

Non-slip terrazzo—a safe floor

Non-slip Stair Treads made with abrasive inserts.

Non-Slip Terrazzo provides safety from the possibility of falls due to slippery conditions on a floor finish. In fact, all Terrazzo provides this safety, but the non-slip type of Terrazzo makes this condition more positive by adding an abrasive aggregate to the Terrazzo matrix. This is a factor worthy of note, because accidental falls on floors account for approximately one-fifth of all injuries in American Industry for which compensation is paid. This condition affects all business from the small to the large establishment but, of course, more acutely affects large Commercial, Institutional and Industrial structures, in which there are hundreds of employees, and in some cases thousands of customers. Because of these conditions the U. S. Bureau of Standards conducted a series of exhaustive tests under varying conditions to determine the anti-slip characteristics of various floor materials, the results of which were published in their report #BMS100 under the title of "Relative Slipperiness of Floor and Deck Surfaces."

Terrazzo, we are glad to advise, made a good record for itself in these tests. In fact, in our opinion, they proved that Terrazzo is a floor finish which provides the necessary safety from accidental falls. A few of the highlights of these tests include:—

1 A person wearing a leather heel is more likely to slip on any surface than one wearing rubber heels.

2 Floor slipperiness can be reduced by roughening the surface, but "rough surfaces are difficult to maintain and keep clean and are not desirable for general indoor use."

3 The slipping hazard is from 2 to 10 times greater on any wet floor than on a dry surface.

The table on page 118 shows the anti-slip coefficients compiled from the Bureau of Standards tests which were conducted on the original surfaces of the various materials with no treatment added. The types having the highest number are regarded as the safest. The Bureau of Standards uses the anti-slip coefficients determined by the tests as yardsticks for rating the various types of flooring. Classed by the Bureau as "poor" for a leather heel is any floor with an anti-slip coefficient of less than .15—for a rubber heel, less than .25. A "fair" rating is given flooring with coefficient of .15 to .30 under a leather heel, and .25 to .40 with rubber. Rated as "good" is the flooring having a coefficient of more than .30 with a leather heel and more than .40 with a rubber heel.

We have always maintained that Terrazzo in itself is not inherently slippery and these tests, we believe, certainly indicate this fact. Furthermore, as mentioned previously, by the addition of an abrasive aggregate to the matrix, Terrazzo is made more non-slip and thus provides even greater safety factors than mentioned above. The amount of abrasive aggregate that shall be added to the Terrazzo mixtures depends upon the use to which the floor will be put, as well as on the amount of traffic it will carry, either light or heavy. Recommended percentages of abrasive aggregates to be used in Non-Slip Terrazzo floors are given you in our Standard Specifications for Terrazzo work.

Safety factors in Terrazzo floors depend considerably on proper maintenance, because if dirty scum is allowed to accumulate on the surface, this

non-slip terrazzo

TYPE OF FLOOR	LEATHER HEEL				RUBBER HEEL			
	DRY, CLEAN	DRY, DIRTY	WET, CLEAN	WET, DIRTY	DRY, CLEAN	DRY, DIRTY	WET, CLEAN	WET, DIRTY
TERRAZZO	.37	.40	.22	.18	.80	.44	.26	.18
CEMENT	.44	.47	.40	.40	.66	.58	.55	.55
ASPHALT TILE	.47	.44	.15	.11	.80	.44	.29	.26
CERAMIC TILE	.40	.40	.15	.07	.73	.44	.26	.22
CORK TILE	.47	.47	.22	.15	.73	.47	.37	.22
LINOLEUM	.40	.44	.21	.15	.77	.47	.33	.22
RUBBER TILE	.33	.40	.18	.18	.77	.44	.22	.33
WOOD (OAK)	.26	.41	.36	.28	.79	.45	.39	.27
MAGNESITE	.44	.44	.04	.04	.66	.47	.26	.26
TERRAZZO WITH ABRAS. AGGR.	.44	.47	.26	.22	.86	.47	.40	.26

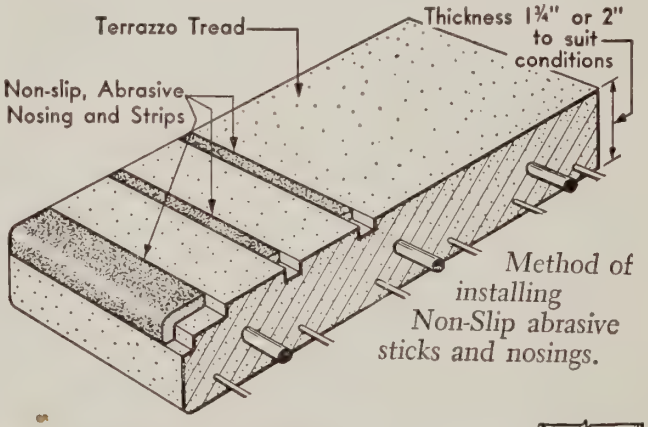
ruins the effectiveness of the abrasive aggregate in same and thus the safety coefficient is lessened. We therefore recommend that Terrazzo floors be cleaned with materials that have proven suitable for this purpose by actual job usage. These various factors we believe will confirm our statement that Non-Slip Terrazzo is a Safe Floor.

NON SLIP STRIPS (STICKS)

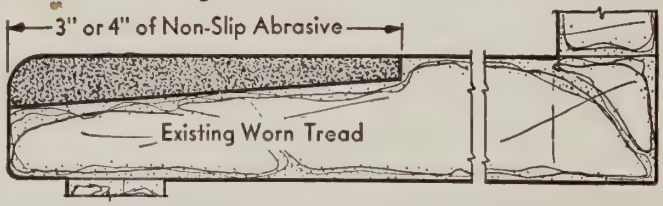
These non-slip strips (sticks) (see illustration) are manufactured in standard dimensions. The sticks are ¼" wide x ⅜" thick and 18" long. They are made of abrasive grains, vitrified and shaped into sticks. In run in place Terrazzo (or precast) grooves are moulded into the tread or ramp according to dimensions as mentioned above, with an additional 1/32 inch, on sides and bottom, for cementing strips into the grooves.

On new or existing treads the grooves are cut into the tread parallel with the nosing by a portable electric machine and spaced as shown in the illustration. Set these strips (they are tapered) with the widest part at the bottom and allow the top to project one-thirty second of an inch. Proceed in like manner when making a ramp safety secure.

A non-slip plastic compound is also employed in making stair treads and ramps secure against slipping. This material is an abrasive plastic compound which is troweled into insert recesses or recesses provided along edge of nosings. It is also a very practical means of providing safety security on old and worn marble or stone steps. By cutting out and recessing worn nosings or tread areas, to receive an application of non-slip plastic material, will not alone restore a stair to its original appearance, but will also make it slip proof.



Method of installing Non-Slip abrasive sticks and nosings.

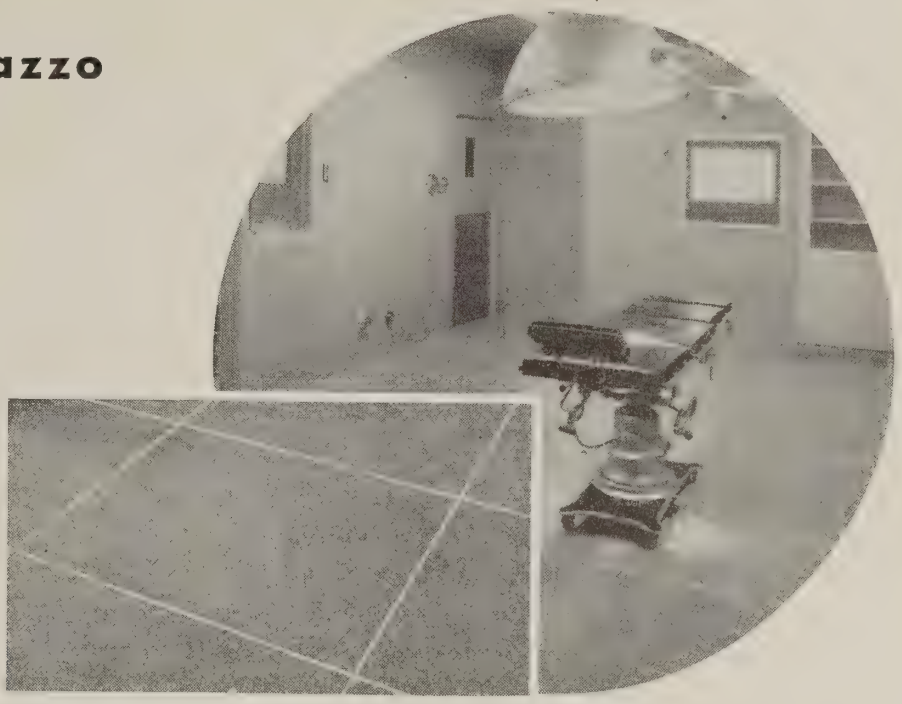


Method of installing Non-Slip plastic abrasive compound.

The recesses can be cut to pattern and filled with colored non-slip plastic, creating a decorative pattern, as well as making the treads safety secure. The non-slip plastic compound can also be colored to match the color of existing material in stairs.

Conductive terrazzo

For safety in anesthetizing Locations



Operating Suite—New Clinical Center—National Institutes of Health, Bethesda, Md.

Although metal grille or grid terrazzo floors have been in use for over a quarter of a century, current thinking favors the principle of moderate overall conductivity for hospital floors in anesthetizing locations such as surgical and obstetrical suites. Requirements of the United States Public Health Service and the National Fire Protection Association for such floors are now generally accepted as desirable and satisfactory.

Under service conditions and all over the country, many acetylene carbon terrazzo operating room floors placed during the past three years are continuing to meet these requirements, including those of accepted minimum and maximum electrical resistance. Now hospital architects and owners can specify and operators and staffs can use acetylene carbon terrazzo with assurance that it has proven itself in actual service. The many proven advantages of Portland Cement terrazzo for hospitals—its dependability, ease of maintenance, long life and attractive appearance under severe service conditions—are thus available in a conductive surface.

The moderate conductivity of these floors is due to inclusion of small percentages of acetylene carbon black in both the terrazzo floor topping and underbed. Petroleum carbon, which has been used for coloring purposes in terrazzo, does not give proper conductivity. Use of the proper carbon black and simple precautions in mixing, placing, and finishing, are all that are required over and above the normal terrazzo installation procedure covered by existing National Terrazzo and Mosaic Association specifications.

With permission of the United States Public Health Service and the Construction Specifications Institute, on the reverse side hereof appear that portion of their specifications pertaining to acetylene carbon black for conductive terrazzo, which appeared originally in an article entitled "Low-Cost Conductive Flooring for Hospitals" published in THE CONSTRUCTION SPECIFIER of July, 1949.

Also on the reverse side hereof appear with permission of the National Fire Protection Association, certain excerpts from their standard N. F. P. A. No. 56 "Recommended Safe Practice for Hospital Operating Rooms—1952" which are of particular importance as to resistance limits, test methods, maintenance and certain general considerations on conductive floors.

To all those concerned with design, construction, operation and maintenance of conductive operating room floors, we recommend complete familiarity with both publications referred to above.

conductive terrazzo

Excerpt from "Low Cost Conductive Flooring for Hospitals," reprinted from the Construction Specifier, July, 1949. A Publication of the Construction Specifications Institute, Inc., 1825 K Street, N. W., Washington 6, D. C., by Federal Security Agency, Public Health Service, Division of Hospital Facilities, Technical Services Branch.

TERRAZZO (Basic Guide Specifications)

Construct as in commercial practice in accordance with the standards established by the National Terrazzo & Mosaic Association, Inc., except that carbon black* shall be added to the cement in both underbed and topping, and other special requirements, as specified below.

Underbed—The terrazzo underbed shall consist of one part of portland cement and four parts coarse screened sand. Carbon black* shall be added to the cement at the rate of 3% by weight of dry cement. This mortar shall be thoroughly mixed, then evenly spread on the concrete subfloor and be brought to a level not less than ⅝" (preferably ¾") below the finished floor. Installed and embedded in the underbed or between the underbed and topping shall be a mesh of galvanized iron wire, copper, or other suitable highly conductive metal. Mesh strands should not be smaller than 18 gauge galvanized iron wire or 20 gauge copper wire. Mesh openings should be not more than the equivalent of 2" x 2" for 18 gauge iron wire, nor more than 6" x 6" for 20 gauge copper wire, and in no case greater than 6" x 6" where heavier mesh is used. A ground or test connection should be bonded to the wire mesh. If grounding is required, the mesh should be permanently and effectively grounded to a cold water pipe or other suitable ground connection. Such a ground connection does not affect the static hazard but slightly increases the hazard for electric shock, unless an insulated supply circuit is used such as furnished by an insulating transformer.

Dividing Strips—The terrazzo shall be jointed with plastic or other similar non-metallic dividing strips not less than 1¼" deep, and forming squares of from 2' to 3' in each direction. While the underbed is in a semi-plastic state, the divider strips shall be installed into the underbed so that the top edges will be flush with the finished floor surface.

Topping—The terrazzo topping shall consist of one part portland cement and two parts marble granule, by weight. Carbon black* shall be added to the cement at the rate of 2.0% by weight of dry cement, then all materials shall be mixed dry before water is added. The marble granule portion should be made up with one part of No. 1 granules and one part of No. 2 granules of any desired color. Placing and finish of this mixture should conform to the requirements for standard terrazzo work, as in commercial practice.

** Carbon black shall be of a special form produced by the thermal decomposition of acetylene gas under carefully controlled conditions. One source of supply is Shawinigan Products Corp., Empire State Building, New York, N. Y. The product name, "Acetylene Black," is manufactured in only one grade but is packed both 50% and 100% compression, either of which is satisfactory. Its cost is about 22¢ per pound f. o. b. Jersey City, N. J. Other sources of supply of carbon black of equal grade and specifications will be acceptable. It should be noted that carbon black of petroleum derivatives is not suitable.*

Excerpts from NFPA No. 56. Recommended "Safe Practice for Hospital Operating Rooms," June, 1952, by National Fire Protection Association (International) 60 Batterymarch Street, Boston 10, Massachusetts.

6-2 Conductive Flooring.

(a) Resistance. (See also Appendix A-6-2.)

1. To prevent the accumulation of dangerous electrostatic charges, the surface of the floor in the locations specified by Section 6-1 shall provide a path of moderate electrical conductivity between all persons and equipment making contact with the floor. No point on a non-conductive element in the surface of the floor shall be more than ¼ inch from a conductive element of the surface.

Note: It is not necessary to provide a special floor-to-ground connection unless required by the authority having jurisdiction.

2. The resistance of the conductive floor shall be less than 1,000,000 ohms as measured between two electrodes placed three feet apart at any points on the floor.

3. For additional protection against electric shock, the resistance of the floor shall be more than 25,000 ohms, as measured between a ground connection and an electrode placed at any point on the floor, and also as measured between two electrodes placed 3 feet apart at any points on the floor.

(b) Method of Test

1. The floor shall be clean and dry and the room shall be free of explosive gas mixtures. Each electrode shall weigh 5 pounds and shall have a dry, flat, circular contact area 2½ inches in diameter which shall comprise a surface of aluminum or tin foil 0.0005 to 0.001 inch thick backed by a layer of rubber ¼ inch thick and measuring 50 plus or minus ten hardness as determined with a Shore Type A durometer. (American Society for Testing Materials Tentative Method of Test for Indentation of Rubber by Means of a Durometer, ASTM Designation D676-49T, obtainable from ASTM, 1916 Race Street, Philadelphia 3, Pa.)

2. A suitably calibrated ohmeter with a nominal open-circuit output voltage of 500 volts D. C. and a short-circuited current of 2.5 to 10 milliamperes shall be used. Measurements* shall be made at five or more locations in each room and the results averaged. For compliance with section 6-2(a)2, the average shall be within the limits specified and no value shall be greater than 5 megohms. For compliance with section 6-2(a)3, where resistance to ground is measured, two measurements shall be made at each location, with the test leads interchanged at the instrument between measurements, with the average to be taken as the resistance to ground at that location. For compliance, no location shall have average resistance of less than 10,000 ohms and the average for all locations shall be greater than 25,000 ohms. All readings shall be taken with the electrode or electrodes more than three feet from any ground connection or grounded object resting on the floor.

13-10 Testing and Maintenance

(a) The resistance of conductive floors and conductive equipment shall be initially tested prior to use as described in section 6. Thereafter, measurements shall be taken at intervals of not more than one month. A permanent record shall be kept of the readings. The monthly tests can conveniently consist of measurements of the resistance between an electrode placed on the floor and an electrode placed successively on each major article of furniture in the room. Additional tests of any individual item should be made if the measured resistance exceeds 5 megohms.

(b) To be effective conductive floors must not be insulated by a film of oil or wax. Any waxes, polishes or dressings used for floor maintenance of conductive floors should be of an electro-conductive type.

A-6-2 Conductive Flooring

In hazardous locations, a conductive floor serves as a convenient means of electrically connecting persons and objects together to prevent the accumulation of electrostatic charges. A resistance not exceeding 5 to 10 megohms between the objects or persons is generally sufficient to prevent dangerous voltages. The upper limit of 1,000,000 ohms for the resistance of the floor has been chosen as meeting this requirement with a reasonable factor of safety and with reasonable provision for other resistances in the conductive path.

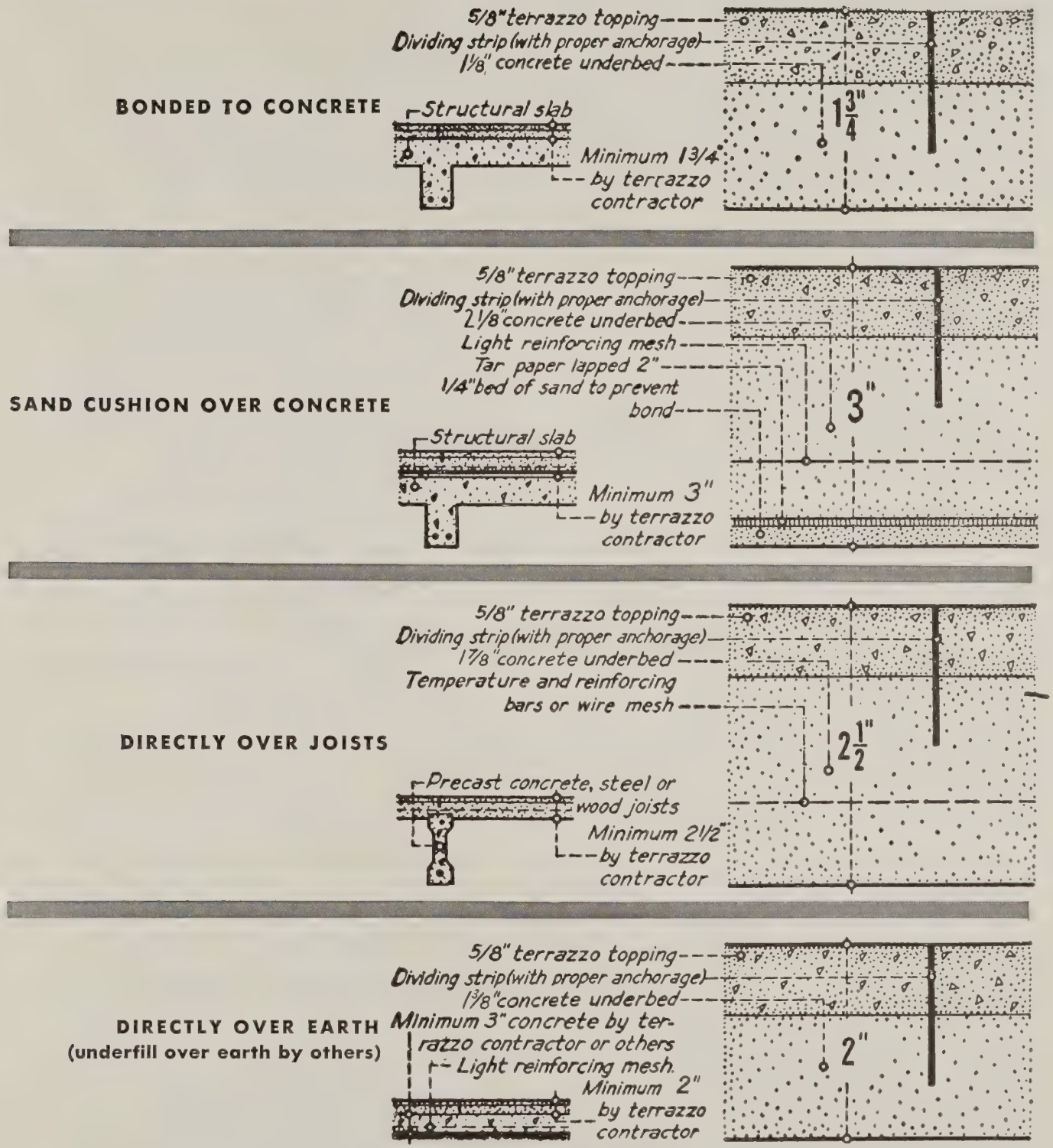
The conductive floor produces a definite shock hazard in the absence of an isolated electrical system. The insulating transformer must always be installed simultaneously with or prior to the installation of the conductive floor. Installation in the opposite sequence is definitely dangerous and should not be contemplated.

The resistance of some flooring materials increases with age. Floors of such materials should have an initial resistance low enough to permit increases in resistance with age without exceeding the limits prescribed in Section 6-2(a)2.

A conductive floor need not be provided with a special grounding connection to prevent the accumulation of charges due to the motion of objects of persons resting on it. To be effective it is necessary only that it be conductive and that the persons and objects be electrically connected to it. Considerable conductivity to ground is generally attained in the usual construction, often because of the proximity of grounded conduits and water pipes. This incidental conductivity to ground and the large area, and therefore capacitance of the floor, make any hazard due to the entry of charged persons or objects into the protected zone negligible, provided such persons and objects have proper conductivity to the floor. Grounded objects within the room, such as portable electrical equipment, will be electrically connected to the floor by the requirements of Section 6, and will thus ground the floor, so that such objects do not increase this electrostatic hazard. Therefore, a special grounding connection need not be incorporated in the floor for electrostatic protection, unless desired or otherwise requested.

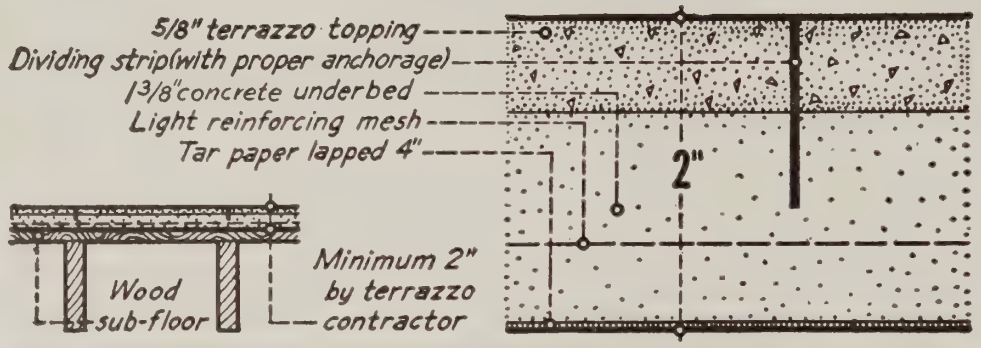
** Note: If the resistance changes appreciably with time during a measurement, the value observed after the voltage has been applied for about 5 seconds shall be considered to be the measured value.*

Terrazzo floors

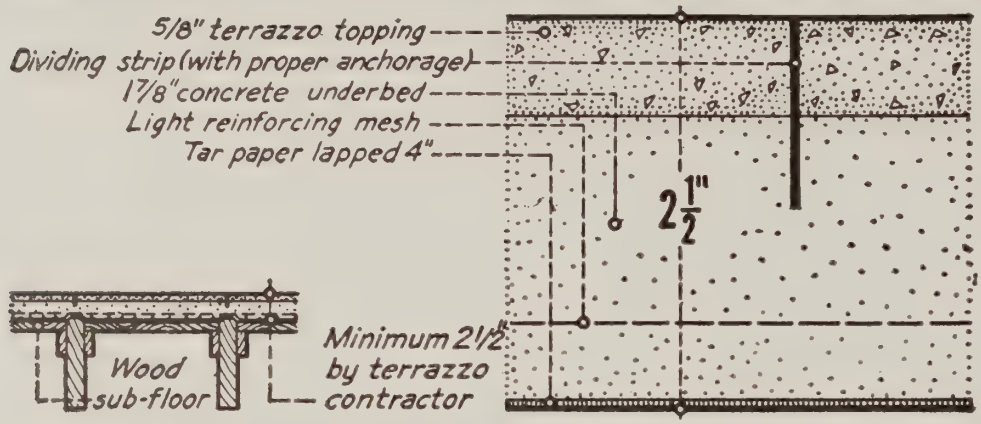


Terrazzo topping-200 lbs. marble granule to not less than 100 lbs. white or gray portland cement. Underbed 1 cement: 4 sand. Dividing strips to be indicated on plans and/or specified to show: 1). Depth: (1¼" is standard). 2). Gage or face thickness. 3). Material: Brass, White Metal or Composition. 4). Spacing and arrangement.

Terrazzo floors

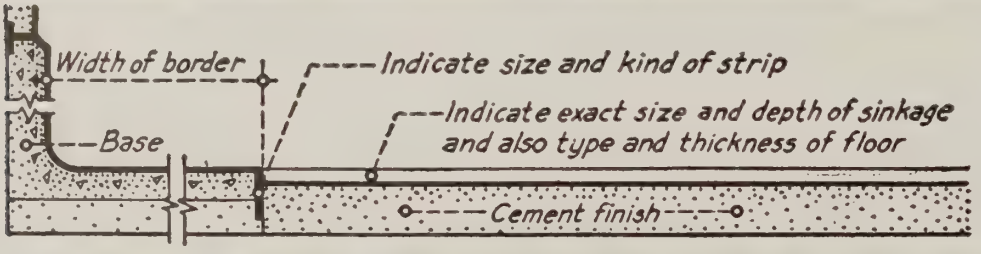


WOOD CONSTRUCTION

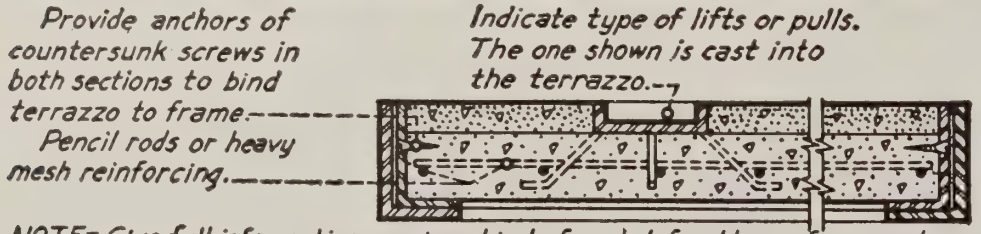


NEW OR OLD WOOD CONSTRUCTION

Terrazzo topping-200 lbs. marble granule to not less than 100 lbs. white or gray portland cement. Underbed 1 cement: 4 sand. Dividing strips to be indicated on plans and/or specified to show: 1). Depth (1¼" is standard). 2). Gage or face thickness. 3). Material: Brass, White Metal or composition. 4). Spacing and arrangement.


Width of border
Indicate size and kind of strip
Indicate exact size and depth of sinkage and also type and thickness of floor
Base
Cement finish

SINKAGE FOR CARPET, LINOLEUM, ETC.


Provide anchors of countersunk screws in both sections to bind terrazzo to frame.
Pencil rods or heavy mesh reinforcing.
Indicate type of lifts or pulls. The one shown is cast into the terrazzo.

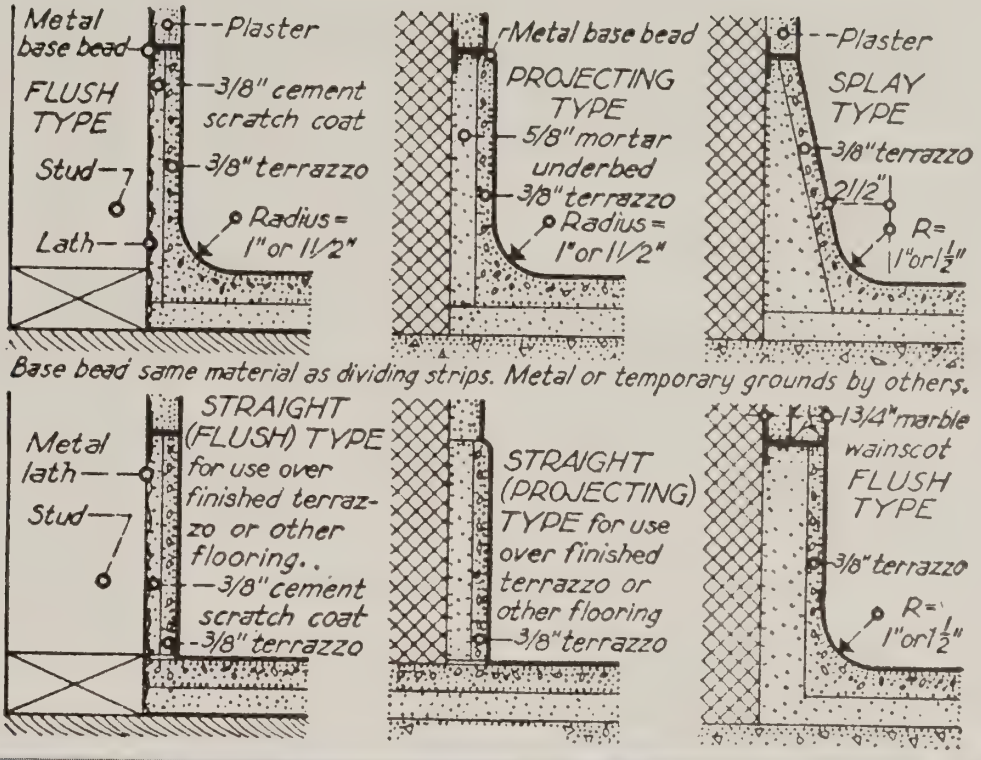
TRENCH COVER

NOTE- Give full information on size, kind of metal for these frames to be furnished and set by the terrazzo contractor.

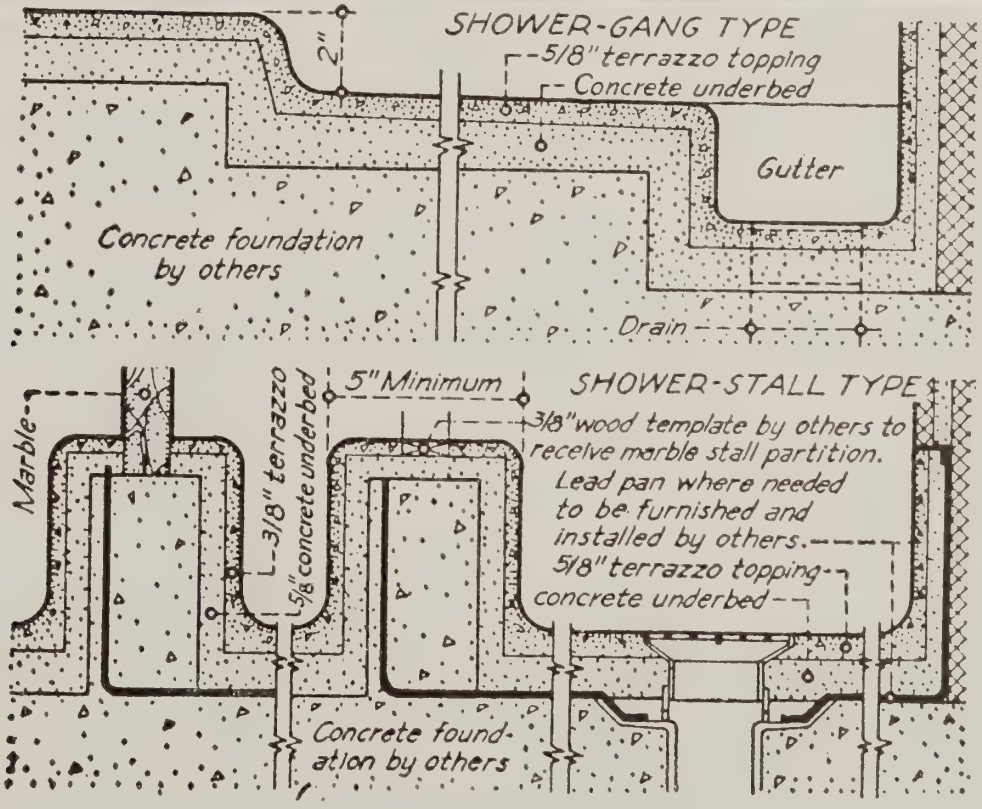
architectural details

Terrazzo bases and shower stalls

BASES

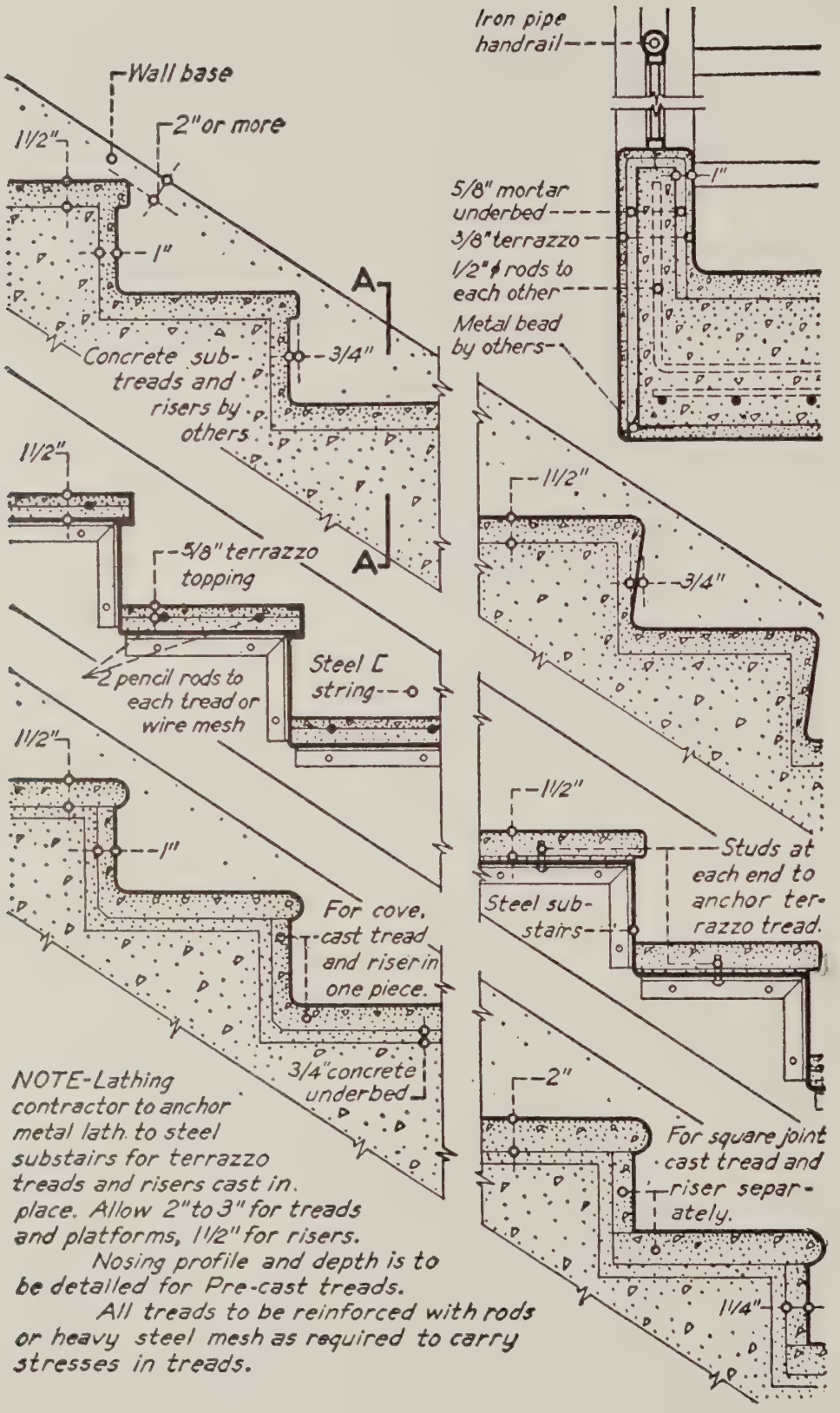


SHOWER FLOORS



architectural details

Terrazzo stair construction



CROSS SECTION OF STRINGER AND TREAD

MONOLITHIC TREAD AND RISER

TERRAZZO TREAD

TREAD AND RISER WITH AND WITHOUT CORE

NOTE-Lathing contractor to anchor metal lath to steel substairs for terrazzo treads and risers cast in place. Allow 2" to 3" for treads and platforms, 1 1/2" for risers.

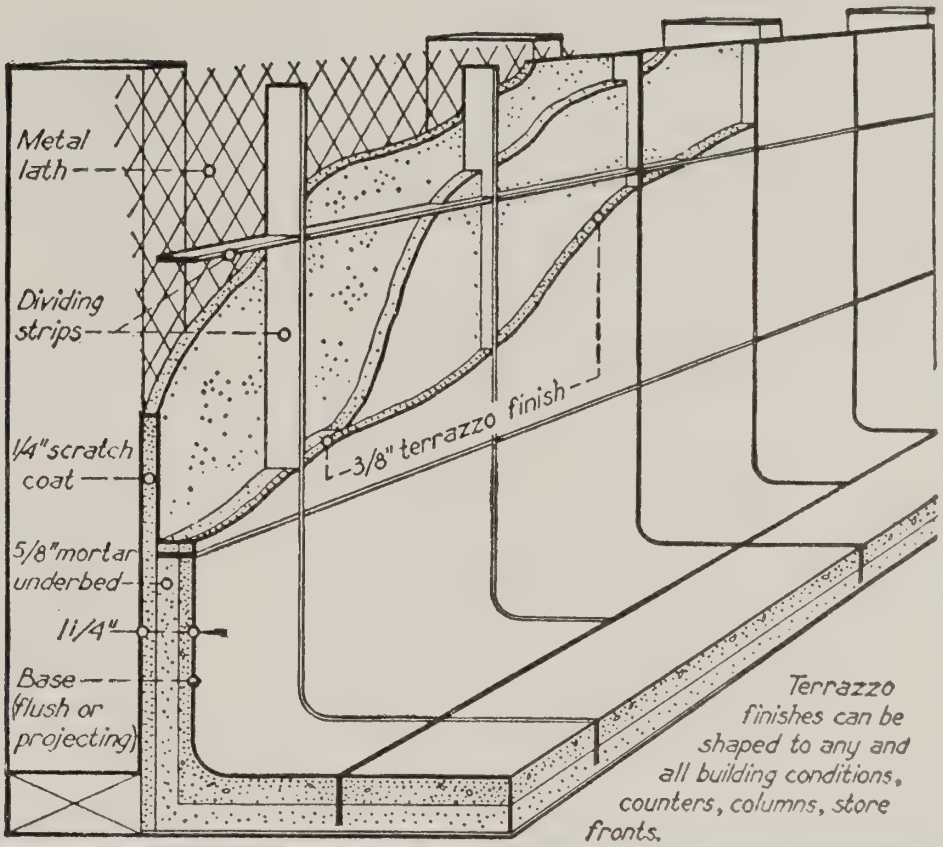
Nosing profile and depth is to be detailed for Pre-cast treads.

All treads to be reinforced with rods or heavy steel mesh as required to carry stresses in treads.

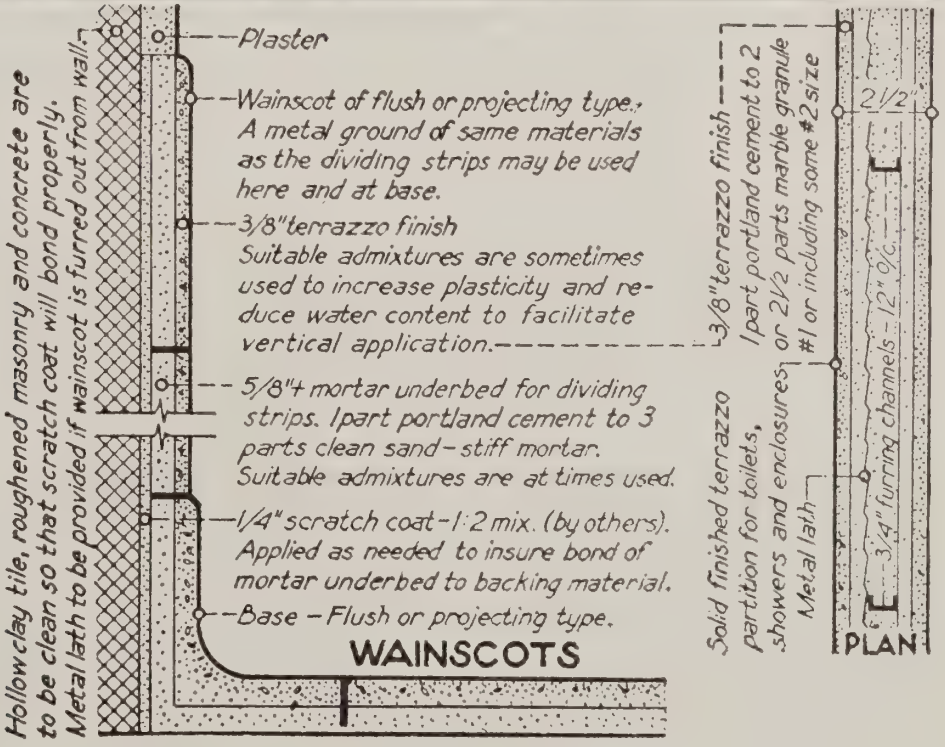
architectural details

Terrazzo wainscots and partitions

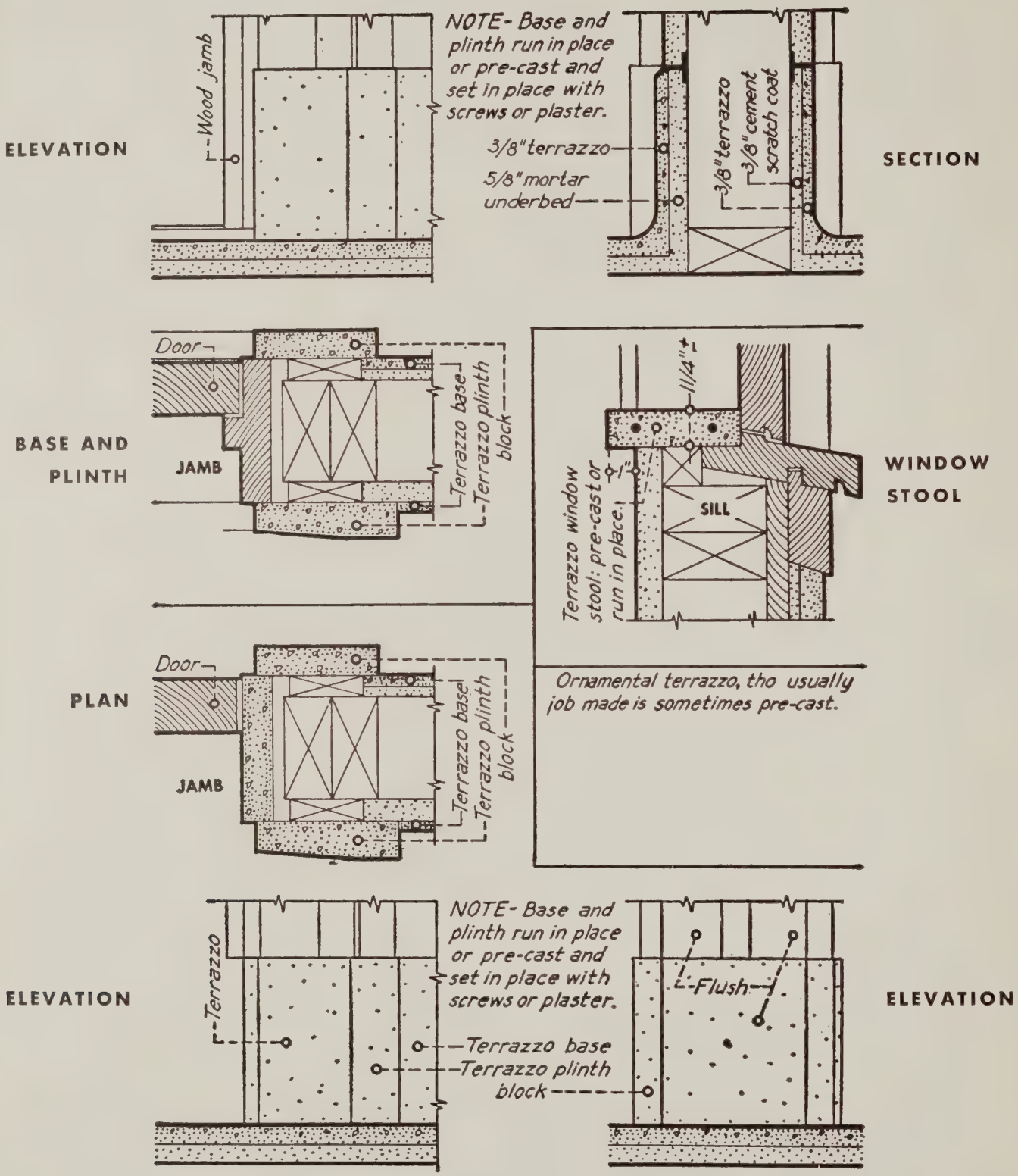
WALLS AND BASE


Metal lath
Dividing strips
1/4" scratch coat
5/8" mortar underbed
11/4"
Base (flush or projecting)
3/8" terrazzo finish
Terrazzo finishes can be shaped to any and all building conditions, counters, columns, store fronts.

CROSS SECTION


Hollow clay tile, roughened masonry and concrete are to be clean so that scratch coat will bond properly. Metal lath to be provided if wainscot is furred out from wall.
Plaster
Wainscot of flush or projecting type. A metal ground of same materials as the dividing strips may be used here and at base.
3/8" terrazzo finish
Suitable admixtures are sometimes used to increase plasticity and reduce water content to facilitate vertical application.
5/8"+ mortar underbed for dividing strips. 1part portland cement to 3 parts clean sand - stiff mortar. Suitable admixtures are at times used.
1/4" scratch coat - 1:2 mix. (by others). Applied as needed to insure bond of mortar underbed to backing material.
Base - Flush or projecting type.
WAINSCOTS
3/8" terrazzo finish
1part portland cement to 2 or 2½ parts marble granule #1 or including some #2 size
Solid finished terrazzo partition for toilets, showers and enclosures
Metal lath
2½"
3/4" furring channels - 12" o/c
PLAN

Terrazzo door trim and window stool



Divider strip location and data

The Purpose of Dividers in terrazzo is to control and localize setting shrinkage and to localize flexure cracks when they occur. Cracks in terrazzo are caused by structural settlement, by expansion and contraction, or by vibration. Crazing or cracks from shrinkage do not occur in properly laid terrazzo. The shrinkage of terrazzo is largely governed by the installation technique and by the rate of evaporation from the surface. Thorough and sufficient rolling is necessary to minimize shrinkage and prevent crazing. Proper curing methods will check evaporation. Correctly located dividers will eliminate promiscuous cracking.

The Floated Type of Terrazzo Floor construction is affected less by structural movements. It is recommended when the use of the deeper sub-bed is warranted as insurance against cracks: as in pattern work, lobbies, corridors, and areas where a desired appearance is important. The sand cushion and paper method is the most effective.

In Pattern Work, plan the layout of the lines of divider strips to form blocks or the usual-sized panels. Use reinforcing mesh cut to the size and shape of these panels and placed well up in the sub-bed. Inconspicuous colored dividers may be used where needed to carry these main divisions through patterns. Concealed felt expansion joints may be used where the installation indicates such a precaution. Pre-assembled units dividing only the terrazzo topping are made up for patterns and decorative work; as are letters, numbers, designs, etc. The preparation of such work is best accomplished in the shop of the divider manufacturers who have equipment and men trained to do it accurately.

Carry a Line of Division through to the wall, unless special provisions are made. Do not let the line of division die out in the field or at a border; but continue it through to the wall or to the edge of the terrazzo. Failure to do this has resulted in much cracking that is entirely needless. Always carry a divider out through the border from a column or pilaster corner. Where wall base is used, the dividers in it serve best when on the line of a floor division. It is a common practice to place them opposite alternate floor strips.

Locate the Dividers at Critical Points to localize and control the crack if and when movement occurs. Such points are tension areas over beams, girders, supporting walls, columns, and around stair openings. Where an expansion joint occurs or the type of construction changes, always use a divider; and a special type may be needed to provide for the almost certain movement. Whenever feasible, place dividers at points where there is a probable change of stress due to rigidity as at the edges of a beam tee or a dropped column head. An effort to anticipate the lines of probable opening is worth while. Place dividers on these lines, whenever possible, to serve as bases for the balance of the layout. Diagonal layouts are not recommended.

Panel Size is dependent on several factors, such as: room size and shape, proposed use of the area, importance of the floor cost, importance of appearance, and decorative cansideration. Reasonably small panels are preferable, even though they cost slightly more. Panels of 16 in. to 30 in. are common in the floors of lobbies, corridors, and public spaces; while stores, commercial work, hospital and institutional rooms, rental and office areas are usually laid in panels ranging from 24 in. up to 50 in. in size.

Wall Base, Borders and Wainscots must be divided. Base and border divisions are mentioned above in the fourth paragraph. Sections ought not to exceed 5 ft.-0 in. or a 6ft.-0 in. maximum. Wainscots should be divided both horizontally and vertically into panels not over 30 in. Small panels are preferable. Shaped dividers for various type of base are stock items, as are strips for wainscots.

Base Beads and Shelf Type Strips are stock items in the same materials used for the floor strips. The beads serve economically as a ground in either flush or projecting types and harmonize in appearance. The shelf type strip is recommended where terrazzo adjoins linoleum or a similar type of floor as it insures a flush joint.

Grounded Grilles for floors of hospital operating suites are made in small panels (4″ x 4″ size is recommended) of metal strips (¾ in. x 1/16 in. solid section is recommended)—interlocked, soldered, and electrically grounded. This type of terrazzo floor is recognized as an effective precaution against explosion from static spark.

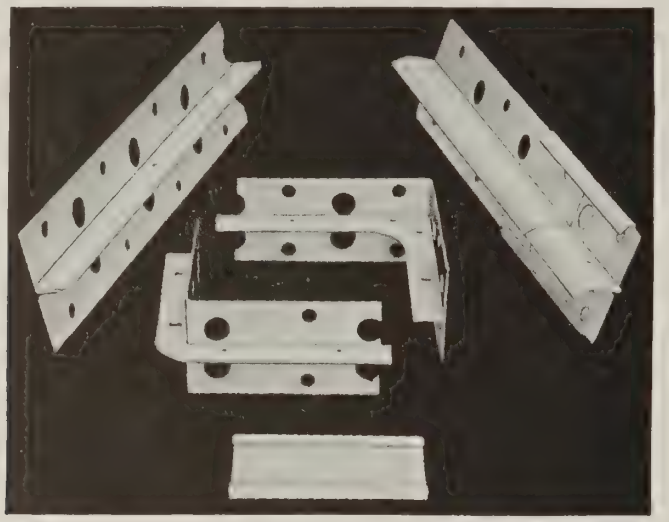
Dividers are made in a variety of sizes. Exposed face thicknesses range up from 20 Brown & Sharpe gage (18 gage is a recommended minimum) to heavy bars. Dividers of ⅛-in. face and wider are usually of the heavy-top type. A 1¼-in. depth divider is recommended for the usual floor thicknesses. Narrow strips are available for special thin floors, borders, wainscots, etc. Standard length of metal floor dividers is 6 ft.-0 in.; of composition dividers 5 ft.-0 in. Special lengths can be mill or factory cut.

The Most Commonly Used Materials for dividers are half-hard brass and a white metal (zinc) alloy, as well as plastic and composition made in various colors.

The Anchorage Features incorporated in the dividers are usually more than ample. The divider must function as such and must have sufficient surface to create a line of cleavage in the terrazzo. *A continuous lower edge cutting the sub-bed is a needed feature.*

Base beads and corners

Flush and projecting type



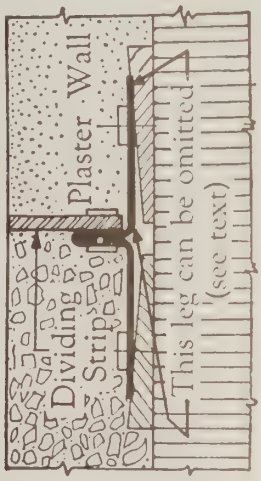
It is frequently desirable, when installing a terrazzo floor, to install a terrazzo base as well. The possibilities of terrazzo as a base material have led to the development of a non-corrosive base bead. The two types of base bead shown on this page fill most base bead requirements. The bottom member is made of galvanized metal in "T" shape, and to the leg of this member are fastened strips of brass, white alloy zinc or plastic. Flush type is available in metal thicknesses from 16 gage to ¼". Projecting type is available in 14 gage metal only. Plastics are available 3/16" and 5/16" thick in flush type only.

When the wall above the base is glass, tile, marble or other non-plastic material, the bead can be furnished without the upper leg (see cut). Splice clips are available. (see photo)

A base bead of this type enables the builder to save time and money. Before the development of this base bead, it was necessary to install wood grounds for the terrazzo base. The installation of this metal base bead by the furring and lathing man ended a long standing controversy between the terrazzo man and the plasterer as to who should install the wood ground. In addition, when the wood grounds were removed, they were a total loss. This type base bead serves as a permanent dividing line and as a permanent ground between base and plaster. The exposed edge of the base bead, being solid, permits extensive grinding without showing breaks—a common difficulty when folded galvanized base beads are used.

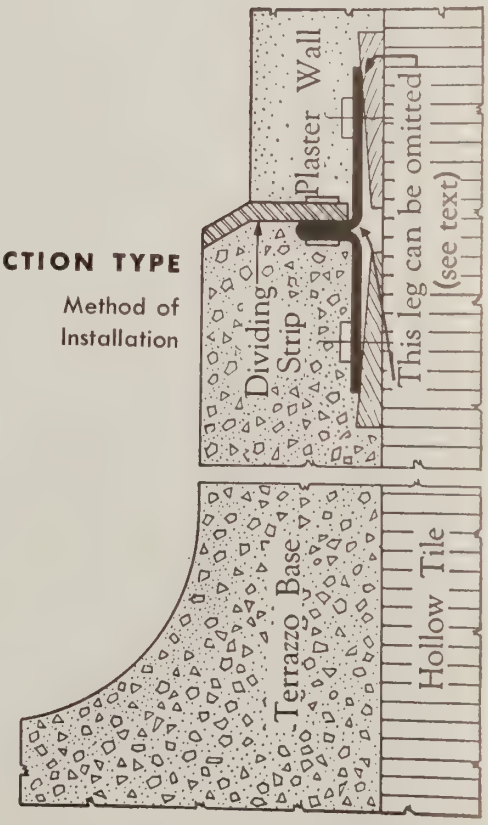
Base Bead to be furnished and installed by Lathing and/or Lathing and Plastering Contractor.

FLUSH TYPE



PROJECTION TYPE

Method of Installation



Outdoor terrazzo

General outline for installation

Terrazzo is well adapted for outdoor usages including such areas as walks, terraces, dance floors, tennis and shuffleboard courts.

For these outdoor installations the procedure outlined below should be followed:

"The concrete foundation slab should be designed with due consideration for frost hazard, drainage, and structural strength. Two inches is a suitable thickness allowance above this slab for the terrazzo work which should be entirely bonded to the structural slab. The use of mastic or prepared felt expansion joints is governed by the same consideration given in other types of pavements except that where it is desired to conceal such joints double divider strips or metal expansion joints are used in the terrazzo topping directly above the mastic joints. Divider strips of either metal or plastic should be used to form panels not larger than 3'-0" on a side.

It is advisable to select a marble granule that will weather; some marbles have better weathering characteristics than others. All mortar colors must be pure mineral pigments because of the action of the sunlight. Terrazzo should be given a proper sealing treatment on completion. Such a treatment is inexpensive and may be repeated each year. It is desirable to protect these outdoor installations in winter with a paper membrane and straw or dirt covering. If, after a few years, the terrazzo becomes dull, an entirely new surface can be created by a relatively inexpensive regrinding.

This terrazzo work is done in accordance with standard practice, but special consideration must be given to the items of joints, marble granule, pigment, and sealing that are more important in outdoor work because of the action of the elements.

Some notable outdoor installations are:

Canal Street, New Orleans, 750,000 square feet;

Sunnyside Beach Dance Floor, Toronto, Canada;

Cascade, Union Station, Cincinnati, Ohio;

Rockefeller Center Rink & Dance Floor, N.Y.C.;

The Prado Promenade, Havana, Cuba.

Roller Skating

Ice Skating

Outdoor Cafe

A Three-In-One Outdoor Terrazzo Installation—Sunken Plaza, Rockefeller Center, New York

Terrazzo and radiant heating

...an ideal combination!

Isometric Drawing of Terrazzo over Radiant Heat Coils

In hundreds of satisfactory installations, terrazzo and radiant heat have proven to be an ideal combination. Although not a new method of heating, not until recent years has it aroused the interest of both architects and builders, as well as owners and occupants.

Concrete-type floors are most generally used for installations of radiant heat and terrazzo provides the ultimate in such a floor. The superior heat conductivity of its marble chip and portland cement content is a definite advantage. Any of the generally used tube materials—copper, iron or steel—may be utilized. Heating engineers find terrazzo surfaces entirely compatible with other phases of system design. Tube Manufacturers and Heating Engineers agree that "Terrazzo is one of the finest conductors of heat and lends itself ideally to floor type radiant heating installations."

Whereas other floor types call for special installations where radiant heating is involved, terrazzo can be installed over the heating coils in accordance with the proven and accepted methods of terrazzo installation outlined in standard specifications of the National Terrazzo and Mosaic Association. Two precautions that have been taken to good advantage are the use of light steel mesh placed over the heating coils before the terrazzo is laid which helps prevent surface cracking, and care to not introduce heat into the system until the terrazzo has thoroughly cured and hardened. Further information is available on request.

Condensed specifications on ice skating rinks of terrazzo

Chicago Stadium — "Terrazzo finish at least ¾" thick when finished. Top to be 1¼" above top of floor pipes. Top of screed to be set 1½" above average level of top of floor pipes to provide ¼" extra thickness for compacting and grinding. Steel screeds with several points of support provided with adjustable screws to rest on the floor pipes shall be set at levels established with an instrument. Terrazzo to be applied practically simultaneously with concrete base and not more than sixty minutes later in any case; the whole must be integral. Once started, work must be carried on continuously until finished. Provide a carefully inspected mixer and have a second mixer in reserve at the job. All ingredients shall be specially measured and carefully proportioned using an accurately determined water-cement ratio. While rolling make frequent checks on levels and grade by means of a leveling instrument. Allow no one for any purpose to go on the floor for at least four days. Do not use the floor for any purpose for at least ten days. Floor must be kept wet by spraying for at least eight days."

Following is a brief explanation: "The work was poured in alternate sections measuring 10′ 8" on a side between the asphalt expansion joints in both directions. The brass strips were set to form 32" squares. The Terrazzo topping in each of these squares was reinforced with a sheet of 18 gage 4" mesh electrically welded wire." The mix used for sub-bed was very dry and thoroughly tamped to eliminate all danger of air pockets and assure a dense and compact bed into which the dividing strips are set.

Madison Square Garden — This had expansion joints of asphalt felt running only in one direction—parallel to the pipes each 10′ for the entire depth of the Terrazzo sub-bed structure. Dividing strips were placed immediately above those and between them every 2′ 6". Dividing strips were set across to complete the 2′ 6" squares. A ⅝" Terrazzo top coat was used on this job.

The sub-bed and Terrazzo are laid with a very short time interval to assure integral construction. Iron shavings were used in the concrete of this job which was laid according to the Funk patent which calls for not less than 6 lbs. of metal turnings per sq. ft. in the sub-bed. (We find no requirement for steel shavings on either the Chicago Arena or the Cleveland Arena projects. Steel shavings were used in the St. Paul rink.) The finished surface is 1¼" above the top of the pipes.

Angles or toe irons make suitable screeds. Several hundred feet may be required to lay the work depending on the width of the floor. Insert an expansion joint at outer edge or perimeter of this floor.

Terrazzo resiliency tests

Resiliency tests. A review of a report of the National Bureau of Standards on "Indentation and Recovery of Low-Cost Floor Coverings" (Report BMS 14-10c) reveals some interesting facts. One test was made with a rod ¼" in diameter under a load of 509 pounds per square inch. In 30 seconds, battleship linoleum indented about .018"; while under the same conditions, asphalt tile indented less than .001" or about 5% as much. Regular inlaid linoleum and rubber tile showed about the same indentation: About 30% as much as the battleship linoleum. There was no appreciable difference in the indentation for asphalt tile and for wood, which was practically nothing.

The report states that this initial indentation "is used as an approximate measure of the relative comfort value." On that basis, there is no practical or actual difference between terrazzo, wood, or asphalt tile. This test refutes the claim that asphalt tile is resilient or that wood "gives."

These tests indicate that for all practical purposes, affecting human fatigue that there is no more "give" under the heel or foot in wood, asphalt tile, or even in regular inlaid linoleum, than there is in terrazzo. With respect to resiliency, these floor coverings are *no less* tiring than terrazzo. "Easy on the feet" is only a myth and it is misrepresentation to call those materials "resilient" as these National Bureau of Standards tests prove they are not.

It is well to mention here the difference between "resilience" and "plastic flow." Resilience with respect to walking on a floor is a measure of the instantaneous yielding of the surface to the impact of the heel *and the return to the original surface*. The fact that asphalt tile and linoleum will indent under long-time pressure, such as a table leg, is no measure of its resilience.

Interesting facts on terrazzo. Terrazzo laid centuries ago in Italy is still in use!

Terrazzo is not a composition, but a mixture of portland cement and genuine marble chips.

The beauty and endurance of terrazzo is due greatly to the skilled artisans who install the work.

Unlike other floor finishes, terrazzo improves with age rather than deteriorating.

Terrazzo is plastic and, therefore, is adaptable to any shape, size, or contour of surface.

Terrazzo is not only used for floors and wall base, but for wainscot, stair treads, risers, facia and stringers, toilet partitions and wash basins, and shower stall receptors. Terrazzo floors and wall base seal out vermin and termites and are a boon to owners of buildings in tropical and semi-tropical climates.

Innumerable colors and designs are obtainable with terrazzo through the use of portland cement, mineral colors, and dividing strips of metal or composition.

The possibilities for use of terrazzo are unlimited, as the following list of installations indicate: dance floors and skating rinks, either indoors or out; public sidewalks (in one city sixteen city blocks are completely terrazzo, center promenade and sidewalk!), swimming pools, tennis courts, shuffleboard courts, and bowling alleys!

The cost of terrazzo setting, considering both installation and maintenance is the *lowest cost per foot per year* by comparison with any other material!

Standard specifications for terrazzo work
as adopted by N. T. M. A.

Methods—*NOTE: Two methods are used in laying terrazzo floors over concrete construction. One is to bond it to the structural slab; the other to separate it, as illustrated on Page 121.*

When the first method is used, the concrete fill is provided for elsewhere, and should be left at least 1¾ in. below the finished floor. This concrete fill can be made of cement, sand, and aggregates in proportion of 1:2:4. Crushed stone, or gravel are generally used as aggregates for concrete fill under terrazzo floors. Before the terrazzo contractor installs his underbed, he must see that the surface of the concrete slab is thoroughly cleaned of plaster droppings, wood chips, and other debris. He should thoroughly slush it with neat cement grout to insure a good bond.

The second method is used in buildings where cracking is anticipated either from settlement, or expansion and contraction, or vibration. In this case, the terrazzo contractor carries his work from the structural floor slab up. This method requires a total thickness of at least 3 in. The concrete slab is covered with a thin bed of dry sand over which a sheet of kraft or tar paper is laid. Over the paper, the underbed is installed as in the first method. When this method is used, the cracks originating in the structural slab terminate at the sand bed and are not likely to appear on the finished surface.

When terrazzo is used over wood floors, a thickness of not less than 2 in. is required and the following procedure should be followed:

First, cover the wood floor with tar paper. Over this paper, lay a reinforcing wire fabric lapped 4". Then, proceed to lay the concrete underbed as specified under the second method.

Underbed—The underbed for terrazzo, consisting of one (1) part Portland cement, and four (4) parts coarse screened sand, shall be spread and brought to a level not less than ⅝ in. below the finished floor.

Strips—Into this underbed, while still in a semi-plastic state, install dividing strips. These shall be 1¼ in. deep and have proper anchoring features; or pre-assembled decorative units may be used. Strips shall form borders and divide the fields into panels——x—— in size, or as shown on the drawings.

NOTE: The strips most commonly used are of half-hard brass. Other non-corrosive metals such as zinc alloy are suitable. The thickness of the strip should be named using Brown and Sharpe gauge. Metal strips less than ⅛ in. thick are made of uniform thickness for their entire depth. Strips ⅛ in. thick or more are of the "heavy top" type having the top member not less than ⅜ in. deep. Composition strips can be used when colored strips are desired.

Terrazzo—The terrazzo topping shall not be less than ⅝ in. in thickness, and shall be of granulated marble of colors to be specified by the architect. The topping shall be uniform in composition, and the same marble granule that appears on the surface shall be used for its entire thickness.

The granule shall be of such proportions of size Nos. 1-2-3 as shall hereafter be determined. Samples of the terrazzo shall be made in duplicate, for approval by the architect.

Mix—Composition for terrazzo shall be in the proportion of two hundred (200) pounds of marble granule to one hundred (100) pounds of Gray or White Portland cement, mixed dry. Add water after the mixing to make the mix plastic but not flowing. Where the cement is to be colored to obtain a desired shade, the color pigments shall be lime-proof and of a non-fading quality.

Installation—The mix shall then be placed in the spaces formed by the dividing strips and rolled into a compact mass by means of heavy stone or metal rollers until all the superfluous cement and water is extracted; after which, it must be hand trowled to an even surface, disclosing the lines of the strips on a level with the terrazzo filling. The finished surface shall show a minimum of 70% marble granule.

Curing—The floor must be kept moist for the next six (6) days at least, by sand, paper, or curing mats.

Surfacing—When, in the judgment of the terrazzo contractor, the floors have set sufficiently hard, they shall be machine rubbed, using No. 24 grit or finer abrasive stones for the initial rubbing. They shall then be resurfaced using a No. 80 grit or finer abrasive stone,

after which a light grouting of neat Portland cement of the same kind and color as the matrix shall be applied to the surface filling all voids. The grouting shall remain until the time of final cleaning.

Finishing—Floors shall have the grouting coat removed by machines, using a stone not coarser than No. 80 grit. This cleaning or fine-stoning shall not take place sooner than seventy-two (72) hours after the floor has been grouted, after which it must be cleaned thoroughly and treated if specified by the architect.

Warning—Acids are injurious to terrazzo and should not be used.

Non-slip Floors—Ramped or other surfaces in terrazzo floors so specified, are to be made non-slip by the addition of an abrasive aggregate.

For heavy duty floors, the proportion shall be two (2) parts of abrasive to three (3) parts of marble granule and the abrasive aggregate shall be mixed in the terrazzo topping for its entire thickness. For light traffic floors, the abrasive shall be sprinkled on the surface only, so that the approximated 70% aggregate surface in the finished floor is three (3) parts marble granule and one (1) part abrasive aggregate.

Terrazzo Base, etc.—Where shown on plans or specified provide a base ——— inches in height, coved at the floor to ——— radius, the top projecting ¼ in. beyond the line of finished plaster.

NOTE: If base is required without projection at top, specify it to be set flush with the finished plaster. Metal base screeds or any temporary grounds are furnished and set by others, and should be specified under another heading.

Base shall be divided into sections not exceeding five (5) lineal feet, using base dividers of B. & S. gauge No.——. The walls back of the base shall have a scratchcoat of cement and sand mortar brought to a line ⅜ in. back of the finished face of the base, into which the base dividers shall be set.

NOTE: If base is to be applied against wood or metal studding, metal lathing must be provided for under lathing specifications.

The surfacing and grouting of terrazzo base shall be done in all respects as described above for the floor. Base shall be finished with a very fine stone, so as to leave the surface at a hone finish. Specifications should state whether terrazzo plinth blocks are required, and whether moulded or plain.

Terrazzo Stairs—Where terrazo stairs are shown or specified to be built upon a concrete slab, the concrete contractor shall form the rough concrete work so as to allow 1½ in. from the top of rough concrete to the top of finished terrazzo tread, and 1 in. from the face of rough concrete riser to finished terrazzo riser.

The rough concrete for strings and curbs shall be so placed by the concrete contractor, as to allow 1 in. for the scratchcoat and finished terrazzo.

Where steel stairs are installed to be finished with terrazzo, same are to be covered with metal lath securely anchored to steel sub-stairs by the lathing contractor, allowing for terrazzo at least 2 in. on the tread, and 1½ in. on the riser. Platforms are to be treated in the same manner, allowing not less than 2 in. for terrazzo and setting bed.

On pan-type stairs where treads only are to be of terrazzo, 1½ in. shall be allowed for terrazzo and setting bed.

Pan treads and platforms must be well reinforced with steel pencil rods. Thickness of terrazzo topping shall be ⅝ in.

NOTE: Refer to description and details of terrazzo stairs on page 124.

Non-slip Work—Treads, Platforms, and Landings shall be made non-slip by mixing 40% abrasive aggregate with 60% marble granule. Colors of marble granule and abrasive aggregate to be as selected.

Terrazzo Wainscots—Under another heading, walls that are to be finished with terrazzo are prepared with a scratchcoat of Portland cement and sand to within 1 in. of finish. Where wall surfaces are of an absorbent material, the plasterer shall use waterproofed cement with the sand for the scratchcoat.

The terrazzo contractor shall apply his setting bed mortar over the scratchcoat to within ⅜ in. of the finished face. This shall be composed of one (1) part cement and three (3) parts sand.

Dividing strips No.——— gauge shall be inserted in the setting bed forming bases and caps and dividing the dado into sections, all as shown on the plans. The terrazzo finish shall then be applied, pressed, and troweled plumb and true.

Terrazzo wainscot shall finish flush with plaster above or project ——— inches beyond same as shown on plans. Terrazzo wainscot shall be machine rubbed and brought to a smooth hone finish (or to a polished finish).

Terrazzo Partitions—Metal lath construction shall be provided by metal lath contractor as follows: Erect forms of metal studding placed not over 12 in. c. to c. and securely fastened at corners, at walls, and over openings; and well bedded into floors. This framing shall be covered with galvanized expanded metal lath.

Plaster contractor shall apply to the metal lath a scratchcoat of one (1) part of Portland cement and two (2) parts screened sand, plumb and true, to within 1 in. of finished face.

Upon surfaces thus prepared the terrazzo contractor shall apply and install the setting bed and terrazzo finish.

The finished thickness of partition shall not exceed 2½ in.

Terrazzo partitions shall be machine rubbed and brought to a smooth hone finish (or to a polished finish).

SPECIFICATIONS FOR MOSAIC

Marble mosaic shall be prepared mounted on paper in the mosaic shop. Patterns and ornamental designs shall be as per approved full-size details.

Wherever marble mosaic floor is to be laid, the concrete foundation will be left 2 in. below the finished floor. Over this, the mosaic worker shall lay an underbed of mortar composed of one (1) part cement and three (3) parts sand, leveled off 1 in. below the finished floor. Then the setting coat shall be spread, composed of one (1) part Portland cement, two (2) parts sand, and a suffcient quantity of lime to make the mortar plastic. The mosaic tesserae shall be embedded into this setting coat.

The mosaic shall be pressed and tamped into the mortar. The paper back shall be removed, and the joints filled with cement. After the mortar has set, the whole floor shall be rubbed by machine and by hand where the machine cannot reach. The joints shall be then carefully grouted again full and smooth. At completion, clean the floor and deliver the work with a smooth hone finished surface.

Glass mosaic for mural decoration shall be prepared on paper in accordance with designs and cartoons, furnished or approved by the architect, in a manner similar to that specified for marble mosaic and shall be set in a mastic composed of a mixture of one (1) part Portland cement, and one (1) part lime putty and three (3) parts clean sharp sand.

The scratchcoat for glass mosaic work shall be of a good quality mixture of Portland cement and screened sand applied to the surface and given a fine cross scratch by plaster contractor who shall leave a uniform thickness of ¾ in. to receive the mosaic work.

All mosaic work shall be well grouted. Glass mosaic shall be left natural and washed perfectly clean.

GENERAL SPECIFICATIONS

Guarantee for Terrazzo and Mosaic

All work shall be guaranteed for a period of one year against defects caused by the use of inferior materials or workmanship.

Maintenance of Terrazzo and Mosaic

Consult your terrazzo contractor for "sealers" and treatments suitable for terrazzo. Do not use resin, varnish or tung-oil base treatments on terrazzo.

Soaps and scrubbing powders containing caustic alkali should never be used in the maintenance of terrazzo and mosaic surfaces.

To properly care for new terrazzo and mosaic floors, they should be scrubbed two or three times a week, and mopped on alternate days. Use a neutral soap, free from alkali, acids, or other strong ingredients, as they may ruin the floor. The floor must be rinsed after each washing so as to prevent it from becoming slippery.

After two or three months of this treatment, the floor will acquire a beautiful natural sheen, and will require less work for its upkeep. Consult the Association's bulletin "Terrazzo Maintenance."

Working Conditions

The following facilities are to be provided free of charge to the terrazzo and mosaic contractor to enable him to carry out his work most economically and with efficiency.

Space for storing his materials and equipment.

Water, light, and heat above freezing point.

Use of elevator or other hoisting facilities and gangways.

Electric power and maintenance of 110 and 220 Volt with connections on each floor, or at least on alternate floors.

Rubbish caused in doing his work will be collected by the terrazzo contractor and placed where designated on each floor, for removal and disposal by others.

Terrazzo maintenance

The physical characteristics of terrazzo—or any flooring materials—must govern the methods and selection of materials for properly treating and cleaning it. Good terrazzo has a smooth surface that is 70% or more of marble, and less than 30% of neat Portland cement matrix. The marble granule is practically non-absorbent. The porosity of the matrix and its ratio of absorption are relatively low.

Suitable materials for treating or cleaning terrazzo floors will fill the original pores or have no effect on them. Harmful materials increase the number and enlarge the pores. Continued use of such harmful materials increases the maintenance problem and cost.

Terrazzo is benefited by a penetrating (not surface) filler or seal. The urgency for the need of such a penetration treatment varies with the floor. This Association recommends that the use of purely surface waxes, varnish preparations, and "good-for-anything" materials be avoided.

New terrazzo, when not given a special treatment, often has a dull, gray appearance. This is caused by a deposit of efflorescent, mineral salts that are a by-product of the setting and curing of the Portland cement. This chemical action continues at a decelerating rate over a period of months, unless the pores of the terrazzo are sealed. This is a normal condition and the deposit is removable by the regular maintenance operations.

New terrazzo and mosaic floors should be scrubbed two or three times a week, and mopped on alternate days. The cleansing agents must be free from alkali, acids, or other strong ingredients that may ruin the floor. The floor must be rinsed after each washing to prevent it from becoming slippery. After two or three months of this treatment, the floor will acquire a beautiful, natural sheen and will require less work for its upkeep.

Terrazzo does not need an artificial or applied surface. Its sheen and lustre are entirely natural. Properly laid terrazzo in its natural condition is a lifetime installation and needs only simple care to preserve its attractive appearance. Artificial or applied surfaces often create or contribute to slipperiness which is not an inherent quality of terrazzo.

Clean terrazzo is not slippery. The factors of slipperiness are the same as those encountered on any smooth surface; principally surface films such as wax, water, oil. A residual film of cleaning material is a common cause of slipperiness. When dirty water and solutions are allowed to dry on terrazzo, they form a film that dulls the appearance and natural color. A gummy or hardened accumulation of this film is often seen along the edges of a floor and a dirty streak is far too common on the wall base. When a heavy film is permitted to form through failure to properly gather up and rinse off dirty water, special work and materials are required to remove it.

Such work must be done by experienced men who can be trusted to handle the strong cleaners and the abrasive materials necessary without damaging the terrazzo. When the terrazzo has been restored to its natural, clean condition, only a little directed effort is needed to avoid the recurrence of film. The correct maintenance methods that do not damage the terrazzo and that maintain its natural beauty, actually cost the least over a period of time.

Low-cost maintenance is a primary consideration to every owner. Many building owners install terrazzo because of this and fail to get it because they are misled into using some cheap, unsuitable material which has a low pound or a low gallon price. The Association's standard specification warns that "soaps and scrubbing powders containing caustic alkali should never be used in the maintenance of terrazzo and mosaic surfaces." Labor is about 95 per cent of the cleaning cost. The difference in cost between cheap and good materials has almost no effect on your total maintenance bill. The cost of special care or the services of experienced men needed because of the use of poor materials far offsets the savings in cost—without considering the appearance and deterioration of your floor.

The proper methods for maintaining the appearance and service of terrazzo floors are very simple: If you seal or give a special treatment to your terrazzo, do it immediately following the installation or following a thorough cleaning so as not to seal in dirt or film. For suitable sealing material, consult any terrazzo contractor.

Mop the floor as frequently as the amount and type of traffic demands. Use a good, neutral cleaner or scouring cleaner solution containing the least amount of cleaner that experience demonstrates is sufficient to loosen the dirt. *Remove the dirt and the dirty water* and rinse the terrazzo clean.

CAUTION: Sweeping compounds containing oil will penetrate and permanently discolor terrazzo.

Thoroughly and vigorously scrub terrazzo at the intervals determined by observing the effectiveness of mopping. The surface should be completely cleaned of all film. Stronger cleansers or abrasives are permissible for these occasional scrubbings, *only if found to be necessary.*

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